



## Substance Abuse

Course # 3175 • 10 CE Hours

*Newly Updated 2010*

### About the Authors

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### Purpose & Goals

The goal of the enclosed course is to provide nurses and other health care professionals with a comprehensive overview of the most commonly used and abused substances in the United States today. Emphasis is on short-and long-term effects, as well as treatment strategies and principles for prevention. Note: Due to the volumes of information available, this course addresses only “Illegally” abused substances, and will NOT cover alcohol, or nicotine.

### Instructional Objectives

1. Define and differentiate among substance use, abuse, and addiction.
2. Name the characteristic signs of substance abuse.
3. Recall the anatomy and neurophysiology of pleasure and its role in drug use.
4. Identify some commonly abused drugs and their characteristic short and long-term effects.
5. List the medical complications associated with various drugs of abuse.
6. Recognize the specific physiological effects of various classes of drugs of abuse.
7. Outline issues and concerns specific to the abuse of prescription & over-the-counter (OTC) medications.
8. List procedures for management of drug overdose.
9. Summarize current approaches to treatment of substance abuse and addiction.
10. Evaluate the efficacy of current strategies for prevention of drug abuse.

### Introduction

Recreational drugs have been around for centuries, but drug abuse has never been so widespread. Marijuana was listed as an agent for achieving euphoria in a Chinese medical

compendium traditionally dated from 2737 B.C. As far back as 2000 B.C., the Greeks used opium and the Aztecs incorporated hallucinogens into their religious rituals. Andean Indians chewed the leaves of the coca plant to decrease hunger and increase their stamina for work. Witches in the Middle Ages brewed potent concoctions, and New World merchants peddled a little opium along with their rum and slaves. Soldiers were among the first addicts to prescription drugs. During the Civil War, the narcotic Laudanum dulled the pain from their battle wounds.

Then along came cocaine and heroin, recommended for every malady from headaches to skin rashes. Cocaine was first extracted from the coca plant in the 19th century, and it was hailed as a miracle drug, prescribed for everything from exhaustion to depression, and widely available in patent medicines. Heroin, first produced in 1874, was sold by traveling salesmen and through mail order catalogs; it was thought to be useful as a cure for respiratory illnesses and for relieving morphine withdrawal. Eventually, the addictive potential of these “harmless cure-alls” was recognized: they were shunned by mainstream society and their use driven underground.

The use of marijuana as an intoxicant was commonplace from the 1850s to the 1930s, and was reinforced by use among migrant workers from Mexico. The Federal Government conducted a campaign in the 1930s to discourage its use. The message of a 1936 movie, “Reefer Madness,” was that “smoking the killer weed was a direct road to hell, suicide, or at least insanity,” and marijuana use came to be regarded as a gateway to addiction to more powerful and dangerous drugs.

Drugs remained on the fringes of society into the 1950s, when the “beat generation” bent their minds with hallucinogens and enhanced their worldly perceptions with pot. By the 1960s, youth rebellion was in full swing, while the hippies of “Hair” and the anti-heroes of “Easy Rider” romanticized the drug culture. Recreational use of drugs was the “in” thing, an activity shared by young people with a common point of view. Following this era, drug use continued to gain in social acceptance, as people thought they could experiment with a wide range of street drugs but not become addicted. Use of the old standbys was on the rise, even as more and more use of amphetamines, inhalants, and designer drugs was recorded.

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A second epidemic in cocaine use began in the United States in the 1970s and peaked in the mid- to late-1980s; again the drug was at first considered relatively harmless. Even middle class America began to use this chic drug in the workplace: it was seen as a quick pick-me-up, a little “perkier” than coffee. “Crack,” a new and inexpensive form of freebase cocaine with magnified effects, hit the markets in the 1980s and soon was widespread in poorer neighborhoods. By the late 1990s the cocaine and crack epidemic had subsided somewhat, however, as heroin regained popularity among illicit drug users. A growing group of new middle-class heroin users emerged in the 1990s as a potent powdered heroin became available. Throughout this period, marijuana retained its role as the gateway to other drug use. After over a decade of decreasing use, marijuana smoking began an upward trend once more in the early 1990s, especially among teenagers.

Despite increased public outcry and an intensification of the government’s war on drugs, it appears that drug abuse will remain a significant public health concern for the foreseeable future. In this course we will outline the neuroanatomy and neurophysiology of drug use, abuse, and addiction; review the most common classes of drugs of abuse; and summarize current approaches to treatment and prevention.

## Understanding Drug Abuse and Addiction

Many people do not understand why individuals become addicted to drugs or how drugs change the brain to foster compulsive drug abuse. They mistakenly view drug abuse and addiction as strictly a social problem and may characterize those who take drugs as morally weak. One very common belief is that drug abusers should be able to just stop taking drugs if they are only willing to change their behavior. What people often underestimate is the complexity of drug addiction—that it is a disease that impacts the brain and because of that, stopping drug abuse is not simply a matter of willpower. Through scientific advances we now know much more about how exactly drugs work in the brain, and we also know that drug addiction can be successfully treated to help people stop abusing drugs and resume their productive lives.

Drug abuse and addiction are a major burden to society. Estimates of the total overall costs of substance abuse in the United States—including health- and crime-related costs as well as losses in productivity—exceed half a trillion dollars annually. This includes approximately \$185 billion for illicit drugs, \$170 billion for tobacco, and \$189 billion for alcohol. Staggering as these numbers are, however, they do not fully describe the breadth of deleterious public health—and safety—implications, which include family disintegration, loss of employment, failure in

school, domestic violence, child abuse, and other crimes.

## Use, Abuse and Dependence

Most experts in addiction medicine differentiate use, abuse, and dependence or addiction, and they are often seen as representing a continuum of severity in assessing a person’s drug problem. Substance **use** is simply the ingestion of a chemically active agent such as a prescription or illicit drug, alcohol or tobacco. Substance **abuse** suggests a maladaptive pattern of substance use leading to significant difficulties in meeting major role obligations at home, work, or school; use in situations in which it is physically hazardous (such as driving); or continued use despite related social and interpersonal problems, or legal problems. **Dependence** implies a cluster of cognitive, behavioral, and physical symptoms which indicate that the individual continues to use the substance despite the presence of significant substance-related problems. The person develops a tolerance for the substance and requires progressively larger amounts to elicit the effects desired. Also, the person will experience physical and psychological signs and symptoms of withdrawal if the substance is not used. **Addiction** typically refers to a compulsive and maladaptive dependence on the substance, resulting in adverse psychological, physical, economic, social, and legal ramifications.

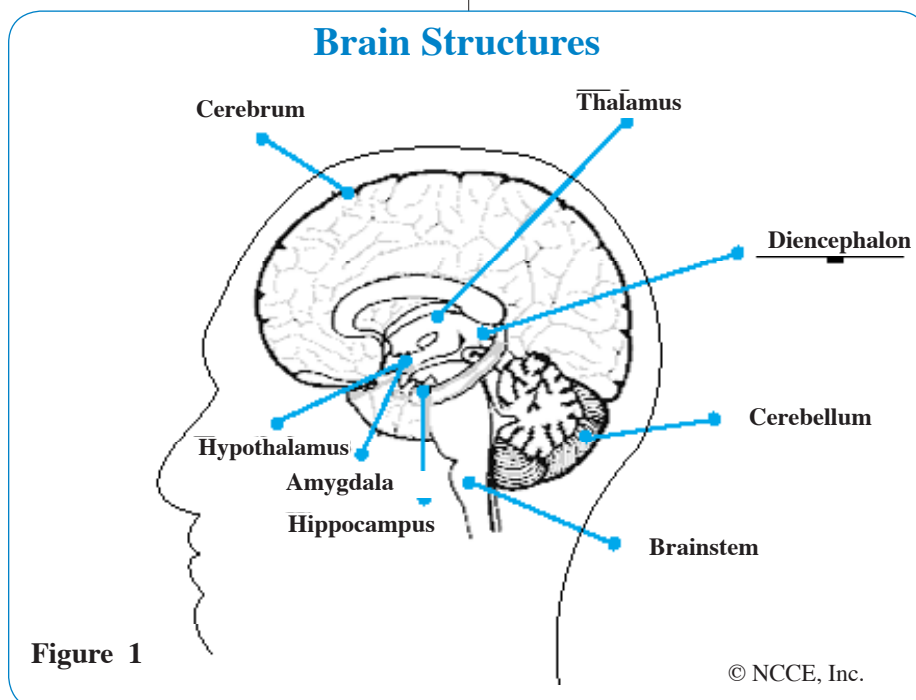
## Neurobiology in Brief

The brain consists of several large regions, each responsible for specific activities vital for living. (*Figure 1*) The **cerebral cortex**, which is divided into right and left hemispheres, encompasses about two-thirds of the brain mass

and lies over and around most of the remaining structures of the brain. It is the most highly developed part of the human brain and is responsible for thinking, perceiving, and producing and understanding language. The cerebral cortex can be divided into areas with each having a specific function, such as vision, hearing, touch, movement, or smell. Other areas are critical for thinking and reasoning. Although many functions, such as touch, are found in both the right and left cerebral hemispheres, some functions are found predominantly in only one hemisphere. For example, in most people, language abilities are localized in the left hemisphere. Even so, the cortex most often acts as a unit in processing for complex tasks, and dysfunction in any one area can affect the operation of the brain as a whole.

The **brainstem** is the part of the brain that connects the brain and the spinal cord. It controls basic functions such as heart rate, respiration, appetite and sleep. The **cerebellum**, a prominent structure located above the brainstem, coordinates the brain’s processes for skilled repetitive movements and for maintaining balance and posture. It has also been implicated in higher level cognitive functions that require complex motor activities.

The **diencephalon**, which is also located beneath the cerebral hemispheres, contains the thalamus and hypothalamus. The thalamus is involved in sensory perception and regulation of motor functions (i.e., movement). It connects areas of the cerebral cortex that are involved in sensory perception and motor control with other parts of the brain and spinal cord that also have a role in sensation and movement. The hypothalamus is a very small but important component of the diencephalon. It plays a major role in regulating hormone production, body



temperature, and many other vital activities.

On top of the brainstem and buried under the cortex, there is a set of more primitive brain structures called the **limbic system**. The limbic system structures are involved in many of our emotions and motivations, particularly those that are related to survival, such as fear, anger, and the pleasure derived from activities like eating and sex. Two large limbic system structures called the amygdala and hippocampus are also involved in memory. One of the reasons that drugs of abuse can exert such powerful control over our behavior is that they act directly on the more primitive brainstem and limbic structures, which can override the cortex in controlling our behavior. In effect, they eliminate the most human part of our brain from its role in behavior control.

The brain is made up of billions of nerve cells, each containing three important parts: a central cell body; short fibers called dendrites that receive messages from other neurons and relay them to the cell body; and an axon, a long single fiber that transmits messages from the cell body to the dendrites of other neurons, or to body tissues such as muscles. Although most neurons contain all three parts, there is much diversity in the shapes and sizes of neurons as well as their axons and dendrites.

The transfer of a message from the axon of one nerve cell to the dendrites of another is known as neurotransmission. Although axons and dendrites are located extremely close to each other, the transmission of a message from an axon to a dendrite does not occur through direct contact. Instead, communication between nerve cells occurs mainly through the release of chemical substances into the space, or synapse, between the axon and dendrites. When neurons communicate, a message, traveling as an electrical impulse, moves down an axon and toward the synapse. There it triggers the release of molecules called neurotransmitters from the axon into the synapse. The neurotransmitters then diffuse across the synapse and bind to special receptor molecules located within the cell membranes of the dendrites of the adjacent nerve cell. This, in turn, stimulates or inhibits an electrical response in the receiving neuron's dendrites.

There are many different types of neurotransmitters, each of which has a precise role to play in the functioning of the brain. Generally, each neurotransmitter can only bind to a very specific matching receptor. Therefore, when a neurotransmitter couples to a receptor, it is like fitting a key into a lock. This coupling then starts a whole cascade of events at both the surface of the dendrite of the receiving nerve cell and inside the cell. In this manner, the message carried by the neurotransmitter is received and processed by the receiving nerve cell. Once this has occurred, the neurotransmitter is inactivated by being either broken down by an enzyme or reabsorbed back into the nerve cell that released

it. The reabsorption (also known as re-uptake) requires the action of transporter molecules, which reside in the cell membranes of the axons that release the neurotransmitters. They pick up specific neurotransmitters from the synapse and carry them back across the cell membrane and into the axon. The neurotransmitters are then available for reuse.

Pleasure is a very powerful biological force for survival. Life-sustaining activities, such as eating, activate a circuit of specialized nerve cells devoted to producing and regulating pleasure. One important set of these nerve cells, which uses a chemical neurotransmitter called dopamine, sits at the very top of the brainstem in the ventral tegmental area (VTA). These dopamine-containing neurons relay messages about pleasure through their nerve fibers to nerve cells in a limbic system structure called the nucleus accumbens. Still other fibers reach to a related part of the frontal region of the cerebral cortex. So, the pleasure circuit, which is known as the mesolimbic dopamine system, spans the survival-oriented brainstem, the emotion-oriented limbic system, and the frontal cerebral cortex.

All drugs that are addicting can activate the brain's pleasure circuit. Drug addiction is a biological, pathological process that alters the way in which the pleasure center, as well as other parts of the brain, functions. Almost all drugs that change the way the brain works do so by affecting chemical neurotransmission. Some drugs, like heroin and LSD, mimic the effects of a natural neurotransmitter. Others, like PCP, block receptors and thereby prevent neuronal messages from getting through. Still others, like cocaine, interfere with the molecules that are responsible for transporting neurotransmitters back into the neurons that released them. (**Figure 2**) Finally, some drugs, such as methamphetamine, act by causing neurotransmitters to be released in greater amounts than normal.

Prolonged drug use changes the brain in fundamental and long-lasting ways. These long-lasting changes are a major component of the addiction itself. It is as though there is a figurative "switch" in the brain that "flips" at some point during an individual's drug use. The point at which this "flip" occurs varies from individual to individual, but the effect of this change is the transformation of a drug abuser to a drug addict.

### Using Technology for Drug Detection

DrugWipe, a patented technology that can instantly detect and identify the 5 major types of illegal narcotics on

a surface down to the nanogram, level is now available to businesses, schools and private companies. The narcotics that can be detected by DrugWipe are Cocaine, Cannabis, Opiates (Heroin), and Amphetamine/Metamphetamines.

Used in the United States by roughly 1,000 national, state and local law enforcement and government agencies since the mid 1990's, this advanced technology produces field reliable results in less than two minutes.

First used in Europe, DrugWipe differentiates itself from other drug detection products currently available by testing for the raw drug, so that trafficking residue can now be detected as well as the sweat deposited from impaired users. DrugWipe technology utilizes patented biosensors to detect and identify the various drug types, the patterns and the location of illegal drug use and trafficking. It is not normally used to pinpoint individual usage.

A "sophisticated lab on a stick," roughly the

## Government Studies Reveal Alarming Data

### Drug abusers on average:

- cost their employer \$7,000 to \$10,000 annually;
- cost companies 300 percent more in medical costs and benefits; and
- are absent up to 16 times more often and are one third less productive.

*A recently released Department of Health and Human Services report stated that 44% of drug users work for small companies. Same study found that 7.7% of workers between the ages of 18 and 49 used illegal drugs in the previous month. Furthermore, young, white, undereducated males are the most likely to use drugs.*

- Drug using employees are 3.6% more likely to be involved in workplace accidents and 5 times more likely to file worker compensation claims.
- 38% - 50% of all workers' compensation claims are related to substance abuse.
- Substance abuse is the third leading cause of workplace violence.
- Substance abusers are 3 times more likely to use medical benefits than other employees.
- Drug users are absent from the workplace an average of 5 days per month due to drug use.
- While at work, substance abusers are 33% less productive and cost their employers \$7,000 annually.



size of a pen, DrugWipe quickly picks up the invisible residue of illegal narcotics with a single “wand-like” motion. DrugWipe is an effective tool for businesses to combat employee theft, increase productivity and reduce workmen compensation claims.

While some may think that drug testing could deter potential employees from choosing a company to work for, it is believed to be just the opposite due to the benefits of a drug-free workplace - to both the employer and the employee. Our research indicates that a drug-free workplace has a distinct advantage in hiring and retaining employees. These tests are a positive, proactive way to deter workplace drug abuse and trafficking and they insure the confidence of employees that they are working in a safe environment. It is a win-win situation for all as it improves workplace moral, lowers insurance premiums, increases quality and productivity, lowers self-insured costs and reduces liability.

## Commonly Abused Substances

### Marijuana

Marijuana has assumed a unique place in our culture and is looked upon benignly by some and with horror by others. Many people smoke marijuana now and then, perhaps combining it with alcohol to “mellow out”, and that is the extent of their drug use. For others, however, especially teenagers, marijuana is a major gateway experience into the drug world. Marijuana is the most commonly abused illicit drug in the United States.

Marijuana is made from the dried leaves and flowers of the Indian hemp plant, *cannabis sativa*. It has been cultivated worldwide and used as a drug for centuries. The potency of marijuana depends on the method of preparation, with hashish and ganja much more powerful than the unprocessed form. Although cannabinoids are usually smoked, they can also be eaten, drunk as tea or, rarely, injected intravenously. The active ingredient of marijuana, delta-9-tetrahydrocannabinol (THC), binds to and activates specific neuroreceptors, called cannabinoid receptors, located throughout the brain in areas that control memory, thought, concentration, time and depth perception, and coordinated movement. THC generally affects these functions negatively, by decreasing the activity of the neurons in each area. Marijuana has been shown to stimulate the dopamine pathway from the ventral tegmental area to the nucleus accumbens, within the pleasure center of the brain, leading to feelings of euphoria, relaxation, and heightened sensation. The THC content of marijuana is currently higher than that of the marijuana used in past decades. Many potential adverse effects that were reported may be understated when compared with the effects of current street preparations.

Peak plasma levels of THC are normally achieved within 10 minutes of smoking marijuana, and intoxication lasts approximately two to three hours. Because of its high lipid solubility, THC accumulates in fatty tissues, leading to its long half-life and related effects. For example, the disruptive effect that marijuana has on coordination may last for more than 24 hours, which is far beyond the period of subjective intoxication.

Many investigations using animals and some studies of humans suggest that reproductive abnormalities may occur with the use of marijuana. Maternal exposure to marijuana during pregnancy may reduce the size of the fetus and the birth weight. A 10-fold increase in the risk of nonlymphoblastic leukemia in children whose mothers used marijuana before or during gestation has also been reported.

Some patients with pre-existing medical conditions who use marijuana may be at particular risk. For example, although THC acutely increases the respiratory rate and the diameter of bronchial airways, chronic use of marijuana results in epithelial damage to the trachea and major bronchi, and decreased airway diameter. Marijuana smoke does not contain nicotine but does have a significantly higher tar content than cigarettes; it contains many carcinogens and, unlike most cigarettes, is smoked unfiltered.

A serious but often neglected adverse effect of marijuana is the risk of infection: chronic use of marijuana may lead to impairment of important pulmonary defenses. Also, marijuana can be contaminated with microorganisms such as aspergillus and salmonella, as well as fecal matter. The risk of infection may be of particular concern in patients who have HIV or AIDS, or other compromise of the immune system.

For many years, it has been known that THC acts on cannabinoid receptors in the brain. It was hypothesized that since the normal brain has these receptors, there must also be a substance produced by the brain itself that acts on these receptors. Finally, in 1992, after years of research, scientists discovered a substance produced by the brain that activates the THC receptors and has many of the same physiological effects as THC. The scientists named the substance anandamide, from a Sanskrit word meaning ‘bliss’. The discovery of anandamide opened whole new avenues of research. It now appears that anandamide and dopamine act in opposite ways to control movements in an area of the brain called the dorsal striatum. Dopamine stimulates movements by acting in this area, and anandamide normally inhibits the action of dopamine.

The discovery of anandamide may lead to a greater understanding of certain health problems and ultimately to more effective treatments. It may be particularly useful in treating diseases related to imbalances of dopamine in the brain, including Parkinson’s disease. When made syn-

thetically and given orally, THC can be used to treat nausea associated with chemotherapy and stimulate appetite in AIDS wasting syndrome. It may also be useful for other conditions, including glaucoma. Now that the brain’s own THC-like substance has been identified, researchers may soon be able to uncover the mechanisms underlying the therapeutic effects of THC, leading to the development of more effective and safer treatments for a variety of conditions.

### Marijuana use rises

The use of illicit drugs among Americans increased between 2008 and 2009 according to a national survey conducted by the Substance Abuse and Mental Health Services Administration (SAMHSA, 2010). The National Survey on Drug Use and Health (NSDUH) shows the overall rate of current illicit drug use in the United States rose from 8.0 percent of the population aged 12 and older in 2008 to 8.7 percent in 2009. This rise in overall drug use was driven in large part by increases in marijuana use. Flat or increasing trends of substance use were reported among youth (12 to 17-year-olds). Additionally, the level of youth perceiving great risk of harm associated with smoking marijuana once or twice a week dropped from 54.7 percent in 2007 to 49.3 percent in 2009, marking the first time since 2002 that less than half of young people perceived great harm in frequent marijuana use. “These results are a wake-up call to the nation,” said SAMHSA Administrator Pamela S. Hyde, J.D. “Our strategies of the past appear to have stalled out with generation ‘next.’ Parents and caregivers, teachers, coaches, faith and community leaders, must find credible new ways to communicate with our youth about the dangers of substance abuse.”

“Today’s findings are disappointing, but not surprising, because eroding attitudes and perceptions of harm about drug use over the past two years have served as warning signs for exactly what we see today.” But our efforts must be reinforced and supported by the messages kids get from their parents.

### Synthetic Marijuana

A relatively new drug on the market, according to a US Department of Justice Drug Alert Watch, K2, also known as “Spice”, or “Space”, is promoted as a legal alternative to marijuana which, when smoked, creates the same hallucinogenic affects but adds many adverse reactions for its user such as tremors, seizures, hypertension, tachycardia, numbness, tingling, vomiting, panic attacks and agitation.

An attraction for potential users is the drug’s inability to be detected in random drug screenings for THC.

Sold in smoke shops, “K2” is a brand name for the synthetic hallucinogen marketed under the names of “spice”, “space”, “hush”, “salvia”, and

“lava,” all which contain the chemical JWH-018.

The euphoric feeling does not come cheap. Pricing out at approximately \$44.95 for two grams and \$84.95 for four grams, with prices adjusted according to potency.

Currently, there is no regulation deeming a minimum age to purchase the product, however, many stores require identification from potential buyers that are at least 18 years old. “You’d be surprised [as to who buys spice blends] if you stand here for an hour,” said the associate, “All ages, even businessmen.”

How dangerous is it? Synthetic marijuana has a very potent, intoxicating results which can range from three to a hundred times greater than THC. These products are produced internationally as well as in the US, without any regulation and are accessible over the counter and on the internet.

## Medical Marijuana: States Going ‘TO POT’?

It appears that marijuana is going mainstream! And the Federal Government is beginning to go with the flow. If the state permits the use of medical marijuana the VA system will no longer refuse to continue to treat the patient. As of July 2010, The Department of Veterans Affairs will formally allow patients treated at its hospitals and clinics to use medical marijuana in states where it is legal, a policy clarification that veterans have sought for several years.

A department directive, resolves the conflict in veterans facilities between federal law, which outlaws marijuana, and the 14 states that allow medicinal use of the drug, effectively deferring to the states.

The policy will NOT permit department doctors to prescribe marijuana. But it will address the concern of many patients who use the drug that they could lose access to their prescription pain medication if caught. Under department rules, veterans can be denied pain medications if they are found to be using illegal drugs. Until now, the department had no written exception for medical marijuana.

The new, written policy applies only to veterans using medical marijuana in states where it is legal. Doctors may still modify a veteran’s treatment plan if the veteran is using marijuana, or decide not to prescribe pain medicine altogether if there is a risk of a drug interaction. But that decision will be made on a case-by-case basis, not as blanket policy.

## Treatment

Identifying patients with a marijuana-related disorder can be difficult, because abuse and associated problems commonly develop slowly. Often, patients do not recognize that they have a problem; if they do, they are perhaps more likely to continue their drug use while intensifying their

efforts to hide it from family, physicians and other authority figures. Although marijuana abuse in adolescents and young adults is of particular concern, it should not be overlooked in other patient groups. For example, persons with certain psychiatric disorders (such as bipolar disorder and post-traumatic stress disorder), those who are under severe emotional distress, and those who have chronic pain might be at increased risk. Ultimately, patients who need treatment will be identified through direct disclosure of marijuana-related problems by the patient, a positive urine drug screen, or identification by legal, school or employment authorities.

Researchers at the U.S. National Institute on Drug Abuse (NIDA) have discovered a way to block the effects of THC on the cannabinoid receptors, thus minimizing the high experienced by marijuana users. The selective cannabinoid CB1 receptor antagonist, rimonabant, chemically blocks the receptors and thus eliminates the intoxication associated with smoking marijuana. Subjects given the highest dose of rimonabant (90 mg) reported a 45.6% reduction in how “high” they felt compared with the control group. The treatment group also had a 59% smaller increase in heart rate, one of the primary physical effects of marijuana. Lead researcher Dr. Marilyn Huestis of NIDA said the findings help point the way toward possible treatment for people addicted to marijuana. “It’s certainly an issue that is still a little controversial,” she said. “But there’s been some beautiful work showing that marijuana is addictive, and that a number of people who utilize the drug on a chronic basis have developed dependence and have a very difficult time stopping taking the drug.” By blocking the brain’s cannabinoid receptors, rimonabant may also prove useful in treating obesity, cigarette smoking, and diseases such as schizophrenia, and improving memory.

## Cocaine

Cocaine, a powerfully addictive stimulant, is one of the oldest known drugs. The pure chemical, cocaine hydrochloride, has been an abused substance for more than 100 years; and coca leaves, the source of cocaine, have been ingested for thousands of years. Cocaine was labeled the drug of the 1980s and ’90s, because of its extensive popularity and use during this period. There are basically two chemical forms of cocaine: the hydrochloride salt and the “freebase.” The hydrochloride salt, or powdered form of cocaine, dissolves in water and, when abused, can be taken intravenously or inhaled. Freebase refers to a compound that has not been neutralized by an acid to make the hydrochloride salt. The freebase form of cocaine is smokeable.

Cocaine is generally sold on the street as a fine, white, crystalline powder, known as “coke,” “C,” “snow,” “flake,” or “blow.” Street dealers

generally dilute it with such inert substances as cornstarch, talcum powder, or sugar, or with such active drugs as procaine (a chemically-related local anesthetic) or with such other stimulants as amphetamines.

***“Short term effects of cocaine include constricted blood vessels; dilated pupils; & increased temperature, heart rate, & blood pressure.”***

Crack (or rock) is the street name given to the freebase form of cocaine that has been processed from the powdered cocaine hydrochloride form to small clumps of smokable substance. Crack cocaine is processed with ammonia or baking soda and water, and heated to remove the hydrochloride. The term “crack” refers to the crackling sound heard when the mixture is smoked. Because crack is smoked, the user experiences a high in less than 10 seconds. This rather immediate euphoric effect is one of the reasons that crack has become enormously popular; another reason is that crack is inexpensive both to produce and to buy.

The principal routes of cocaine administration are oral, intranasal, intravenous, and inhalation. The slang terms for these routes are, respectively, “chewing,” “snorting,” “mainlining,” “injecting,” and “smoking” (including freebase and crack cocaine). Snorting is the process of inhaling cocaine powder through the nostrils, where it is absorbed into the bloodstream through the nasal tissues. Injecting releases the drug directly into the bloodstream, and heightens the intensity of its effects. Smoking involves the inhalation of cocaine vapor or smoke into the lungs, where absorption into the bloodstream is as rapid as by injection. The drug can also be rubbed onto mucous tissues. Some users combine cocaine powder or crack with heroin in a “speedball.”

Cocaine use ranges from occasional use to repeated or compulsive use, with a variety of patterns between these extremes. There is no safe way to use cocaine. Any route of administration can lead to absorption of toxic amounts of cocaine, leading to acute cardiovascular or cerebrovascular emergencies that could result in sudden death. Repeated cocaine use by any route of administration can produce addiction and other adverse health consequences.

Cocaine acts on the pleasure circuit within the brain to prevent reabsorption of the neurotransmitter dopamine after its release from nerve cells. Normally, the neurons that are part of the pleasure circuit release dopamine, which then crosses the synapse to stimulate another

neuron in the pleasure circuit. Once this has been accomplished, the dopamine is picked up by a transporter molecule and carried back into the original neuron. However, because cocaine binds to the dopamine transporter molecule, it prevents the reabsorption of dopamine. This causes a buildup of dopamine in the synapse, which results in strong feelings of pleasure and even euphoria. The excess dopamine that accumulates in the synapse causes the neurons that have dopamine receptors to decrease the number of receptors they make. This is called down regulation. When cocaine is no longer taken and dopamine levels return to their normal (i.e., lower) concentration, the smaller number of dopamine receptors that are available for the neurotransmitter to bind to is insufficient to fully activate nerve cells. This results in a drug “craving,” which compels the addict to get the level of dopamine back up by taking cocaine. Cocaine also binds to the transporters for other neurotransmitters, including serotonin and norepinephrine, and blocks their re-uptake. Scientists are still unsure of the effects of cocaine’s interaction with these other neurotransmitters.

Cocaine has also been found to specifically affect the prefrontal cortex and amygdala, which are involved in aspects of memory and emotional learning. Researchers believe that a neural network involving these brain regions reacts to environmental cues and activates drug-related memories, and this in turn triggers biochemical changes that result in cocaine craving.

Cocaine’s effects appear almost immediately after a single dose, and disappear within a few minutes to hours. If taken in small amounts (100 mg or less), cocaine typically makes the user feel euphoric, sociable, and mentally alert, especially to the sensations of sight, sound, and touch. It can also temporarily decrease the need for food and sleep. Some users say that the drug helps them to perform certain physical and intellectual tasks more quickly, while others experience the opposite effect.

*“Long term use may lead to tolerance, & addicts report they eventually are unable to achieve as much pleasure as they did from their first experience.”*

The duration of cocaine’s immediate effects depends upon the route of administration. The faster the absorption, the more intense the high, and the shorter the duration of action. The high from snorting, for example, is relatively slow in onset, and may last 15 to 30 minutes, while that

from smoking may last only 5 to 10 minutes.

Short-term physiological effects of cocaine include constricted blood vessels; dilated pupils; and increased temperature, heart rate, and blood pressure. Large amounts (several hundred milligrams or more) intensify the user’s high, but may also lead to bizarre, erratic, and violent behavior. These users may experience tremors, vertigo, muscle twitches, paranoia, or, with repeated doses, a toxic reaction closely resembling amphetamine poisoning. Some users of cocaine report feelings of restlessness, irritability, and anxiety. In rare instances, sudden death can occur on the first use of cocaine or unexpectedly thereafter, perhaps the result of cardiac arrest or seizures followed by respiratory arrest.

Long-term use may lead to tolerance, and many addicts report that they eventually are unable to achieve as much pleasure as they did from their first experience. Some users will repeatedly increase their doses in an attempt to intensify and prolong the euphoric effects. While tolerance can occur, users can also become more sensitive to the drug’s anesthetic and convulsant effects, without increasing the dose taken; this may explain some of the deaths that occur after apparently low doses of cocaine. Binge use of cocaine, during which the drug is taken repeatedly and at increasingly high doses, leads to a state of increasing irritability, restlessness, and paranoia. This may result in a full-blown paranoid psychosis, in which the individual loses touch with reality and experiences auditory hallucinations.

Cocaine use has been associated with severe medical complications, including cardiovascular effects such as disturbances in heart rhythm and heart attacks; increased blood pressure and body temperature; chest pain and respiratory failure; neurological effects, including seizure, headaches, strokes, and coma; and gastrointestinal complications, including abdominal pain and nausea. Because cocaine has a tendency to decrease food intake, many chronic cocaine users can experience significant weight loss and malnourishment. Different routes of cocaine administration can produce different adverse effects. Regularly snorting cocaine, for example, can lead to loss of sense of smell, nosebleeds, problems with swallowing, hoarseness, and an overall irritation of the nasal septum, which can in turn lead to a chronically inflamed, runny nose. Ingested cocaine can cause severe bowel gangrene, due to reduced blood flow.

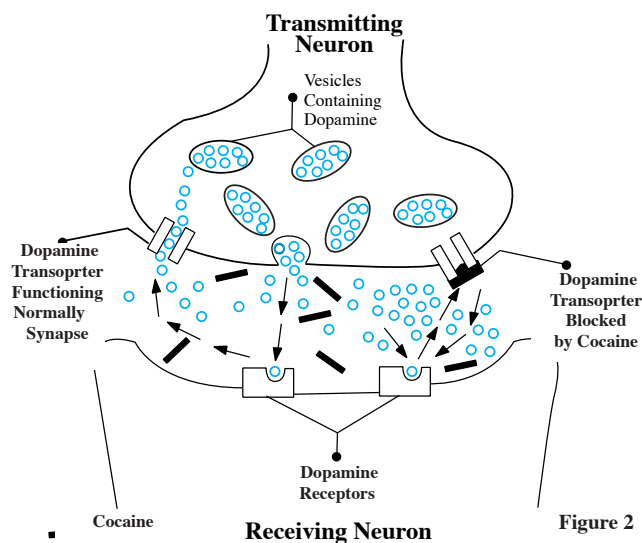
Persons who inject cocaine have puncture marks and “tracks,” most commonly in their forearms. Intravenous cocaine users may experience an allergic reaction to the drug or to some additive, resulting, in the most severe cases, in death. Cocaine abusers, especially those who inject, are at increased risk for contracting such infectious diseases as HIV/AIDS and hepatitis. Research has also shown that drug use can interfere with judgment about risk-taking behaviors, and can potentially lead to reduced precautions about having sex, the sharing of needles and injection paraphernalia, and the trading of sex for drugs, by both men and women.

## Added Danger: Cocaethylene

Polydrug use—use of more than one drug—is common among substance abusers. When people consume two or more psychoactive drugs together, such as cocaine and alcohol, they compound the danger each drug poses and unknowingly perform a complex chemical experiment within their bodies. Researchers have found that the human liver combines cocaine and alcohol to produce a third substance, cocaethylene, which intensifies cocaine’s euphoric effects. Cocaethylene is associated with a greater risk of sudden death than cocaine alone.

The full extent of the effects of prenatal drug exposure on a child is not completely known, but many scientific studies have documented that babies born to mothers who abuse cocaine during pregnancy are often prematurely delivered, have low birth weights and smaller head circumferences, and are often shorter in length. In fact, “crack babies,” or babies born to mothers who used cocaine while pregnant, were written off by many a decade ago as a lost generation. They were predicted to suffer from severe, irreversible brain damage, resulting in reduced

**Cocaine’s Effect on Neurotransmission**



**Figure 2**

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intelligence and social skills. It was later found that this was a gross exaggeration. Most crack-exposed babies appear to recover fairly well. However, the fact that most of these children appear normal should not be over-interpreted as a positive sign. Using more sophisticated technologies, scientists are now finding that exposure to cocaine during fetal development may lead to subtle, but significant deficits later, especially with behaviors that are crucial to success in the classroom, such as blocking out distractions and concentrating for long periods of time.

## Khat

Khat (pronounced “cot”) is a stimulant drug derived from a shrub (*Catha edulis*) that is native to East Africa and southern Arabia. Although the khat plant itself is not scheduled under the Controlled Substances Act, one of its chemical constituents, cathinone, is a Schedule I drug. The Federal Government treats khat as equivalent to cathinone and therefore considers its use illegal.

## Health/Behavioral Effects

The main psychoactive ingredients in khat are cathine and cathinone, chemicals that are structurally similar to, but less potent than, amphetamine, yet result in similar psychomotor stimulant effects. Chewing khat leaves induces a state of euphoria and elation as well as feelings of increased alertness and arousal. The user also experiences an increase in blood pressure and heart rate. The effects begin to subside after about 90 minutes to 3 hours, but can last 24 hours. At the end of a khat session, the user may experience a depressive mood, irritability, loss of appetite, and difficulty sleeping.

There are a number of adverse physical effects that have been associated with heavy or long-term use of khat, including tooth decay and periodontal disease; gastrointestinal disorders such as constipation, ulcers, inflammation of the stomach, and increased risk of upper gastrointestinal tumors; and cardiovascular disorders such as irregular heartbeat, decreased blood flow, and myocardial infarction. There is also consistent epidemiologic evidence for a weak association between chronic khat use and mental disorders. Although there is no evidence that khat use causes mental illness, chewing khat leaves may worsen symptoms in patients who have preexisting psychiatric conditions.

It is unclear whether khat causes tolerance, physical dependency, addiction, or withdrawal, but nightmares and slight trembling have been reported several days after ceasing to chew.

It is estimated that 10 million people worldwide chew khat. It is commonly found in the southwestern part of the Arabian Peninsula and in East Africa, where it has been used for centuries as part of an established cultural tradition. In one large study in Yemen, 82 percent of men and 43 percent of women reported at least

one lifetime episode of khat use. Its current use among particular migrant communities in the United States and in Europe has caused alarm among policymakers and health care professionals. No reliable estimates of prevalence in the United States exist.

## Treatment

The majority of individuals seeking treatment for cocaine addiction smoke crack, and are likely to be poly-drug users as well. The widespread abuse of cocaine has stimulated extensive efforts to develop treatment programs for this type of drug abuse. Cocaine abuse and addiction is a complex problem involving apparently permanent biological changes in the brain as well as a myriad of social, familial, and environmental factors. Therefore, treatment of cocaine addiction is complex, and must address a variety of problems. Like any good treatment plan, cocaine treatment strategies need to assess the psychobiological, social, and pharmacological aspects of the patient’s drug abuse.

## Amphetamines

Amphetamines are potentially addictive drugs that belong to the class of drugs known as stimulants, along with cocaine, caffeine, and others. The amphetamines were first synthesized in the 1920s for use as decongestants and later discovered to be helpful in treating narcolepsy, a rare disorder that causes an uncontrollable desire to sleep. They were effective medications for appetite control, and were good hangover cures as well. Because of their stimulating effects, they became widely sought by students, housewives, athletes, military personnel, truck drivers, and anyone who needed a boost to reduce fatigue, prolong wakefulness, or just get through a bad day. Initially sold over the counter and in inhalers, they were eventually highly regulated with prescriptions required for their use; this in turn led to increased illegal manufacturing of the drug. Amphetamine and its variants, methamphetamine and dextroamphetamine, are so similar in their effects that lab analysis may be the only way to differentiate among them; methamphetamine, however, has more pronounced effects on the central nervous system.

Methamphetamine is commonly known as “speed,” “meth,” and “chalk” or, in its smokeable form, as “ice,” “crystal,” “crank,” or “glass.” It is a white, odorless, bitter-tasting crystalline powder that easily dissolves in water or alcohol. Like amphetamine, it causes increased activity, decreased appetite, and a general sense of well-being. The effects of methamphetamine can last 6 to 8 hours or more. After the initial “rush,” there is typically a state of high agitation that in some individuals can lead to violent behavior.

Methamphetamine can be made easily in clandestine settings with relatively inexpensive over-the-counter ingredients; many such as

drain cleaner, battery acid, and antifreeze are extremely dangerous. The rapid proliferation of so-called “basement” laboratories for the production of methamphetamine has led to a widespread problem in many communities in the U.S. Methamphetamine abuse has long been reported as the dominant drug problem in portions of Southern California, but has become a substantial drug problem in other sections of the West and Southwest as well and continues to spread to other areas of the country, including both rural and urban sections of the South and Midwest. Its use was traditionally associated with white, male, blue-collar workers, but it is being used by ever more diverse population groups that change over time and differ by geographic area.

Methamphetamine comes in many forms and can be smoked, snorted, orally ingested, or injected. The drug alters moods in different ways, depending on how it is taken. Immediately after smoking the drug or injecting it intravenously, the user experiences an intense rush or “flash” that lasts only a few minutes and is described as extremely pleasurable. Snorting or oral ingestion produces euphoria — a high but not an intense rush. Snorting produces effects within 3 to 5 minutes, and oral ingestion produces effects within 15 to 20 minutes.

As with similar stimulants, methamphetamine most often is used in a “binge and crash” pattern. Because tolerance for methamphetamine occurs within minutes — meaning that the pleasurable effects disappear even before the drug concentration in the blood falls significantly — users try to maintain the high by binging on the drug. In the 1980s, “ice,” a “smokeable” form of methamphetamine, came into use. Ice is a large, usually clear crystal of high purity that is smoked in a glass pipe like crack cocaine. The smoke is odorless, leaves a residue that can be re-smoked, and produces effects that may continue for 12 hours or more.

Methamphetamine acts on the pleasure circuit in the brain by altering the levels of certain neurotransmitters present in the synapse. Methamphetamine is chemically similar to dopamine and another neurotransmitter, norepinephrine. It produces its effects by causing dopamine and norepinephrine to be released into the synapse in several areas of the brain, including the nucleus accumbens, prefrontal cortex, and the striatum, a brain area involved in movement. Specifically, methamphetamine enters nerve terminals by passing directly through nerve cell membranes. It is also carried into the nerve terminals by transporter molecules that normally carry dopamine or norepinephrine from the synapse back into the nerve terminal. Once in the nerve terminal, methamphetamine enters dopamine and norepinephrine containing vesicles and causes the release of these neurotransmitters. Enzymes in the cell normally break down excess dopamine and norepinephrine, but methamphetamine blocks this process. The excess neurotransmitters are

then carried by transporter molecules out of the neuron and into the synapse. Once in the synapse, the significantly higher than normal concentration of dopamine causes feelings of pleasure and euphoria. The excess norepinephrine may be responsible for the alertness and anti-fatigue effects of methamphetamine.

Long-term methamphetamine abuse results in many damaging effects, including addiction. Addiction is a chronic, relapsing disease, characterized by compulsive drug-seeking and drug use, which is accompanied by functional and molecular changes in the brain. In addition to being addicted to methamphetamine, chronic methamphetamine abusers exhibit symptoms that can include anxiety, confusion, and insomnia. They also can display a number of psychotic features, including paranoia, auditory and visual hallucinations, mood disturbances, and delusions (for example, the sensation of insects creeping on the skin, called “formication”). The paranoia can result in homicidal as well as suicidal thoughts, and out-of-control rages that can be coupled with extremely violent behavior.

With chronic use, tolerance for methamphetamine can develop. In an effort to intensify the desired effects, users may take higher doses of the drug, take it more frequently, or change their method of drug intake. In some cases, abusers forego food and sleep while indulging in a form of bingeing known as a “run,” injecting as much as a gram of the drug every 2 to 3 hours over several days until the user runs out of the drug or is too disorganized to continue. Although there are no physical manifestations of a withdrawal syndrome when methamphetamine use is stopped, there are several symptoms that occur when a chronic user stops taking the drug. These include depression, anxiety, fatigue, paranoia, aggression, and an intense craving for the drug.

Methamphetamine can also affect the brain in other ways, causing cerebral edema, brain hemorrhage, and hallucinations. Moreover, some of the effects of methamphetamine on the brain appear to be long lasting and even permanent. Recent research has shown that even three years after chronic methamphetamine users have discontinued use of the drug, there remains a reduction in their ability to transport dopamine back into neurons. Researchers have reported that as many as 50 percent of the dopamine-producing cells in the brain can be damaged after prolonged exposure to relatively low levels of methamphetamine. This is highly significant because dopamine has a major role in many brain functions, including experiences of pleasure, mood, and movement. In these same studies, researchers found similarities in the damage to the dopamine system of methamphetamine users to that seen in patients with Parkinson’s disease. Researchers also have found that serotonin-containing nerve cells may be damaged even more extensively. Whether this

toxicity is related to the psychosis seen in some long-term methamphetamine abusers is still an open question.

Methamphetamine can cause a variety of cardiovascular problems. These include rapid heart rate, irregular heartbeat, increased blood pressure, and irreversible, stroke-like damage to the small blood vessels of the brain. Hyperthermia and convulsions occur with methamphetamine overdose, and if not treated immediately can result in death.

Chronic methamphetamine abuse can result in inflammation of the heart lining, and among users who inject the drug, damaged blood vessels and skin abscesses. Methamphetamine abusers also can have episodes of violent behavior, paranoia, anxiety, confusion, and insomnia. Heavy users also show progressive social and occupational deterioration. Psychotic symptoms can sometimes persist for months or years after use has ceased.

A common method of illegal methamphetamine production uses lead acetate as a reagent; therefore, production errors may result in methamphetamine contaminated with lead. There have been documented cases of acute lead poisoning in intravenous methamphetamine abusers.

Fetal exposure to methamphetamine also is a significant problem in the United States. At present, research indicates that methamphetamine abuse during pregnancy may result in prenatal complications, increased rates of premature delivery, and altered neonatal behavioral patterns, such as abnormal reflexes and extreme irritability. Methamphetamine abuse during pregnancy may also be linked to congenital deformities.

## Treatment

There are some established protocols that emergency room physicians use to treat individuals who have had a methamphetamine overdose. Because hyperthermia and convulsions are common and often fatal complications of such overdoses, emergency room treatment focuses on the immediate physical symptoms. Overdose patients are cooled off in ice baths, and anticonvulsant drugs may also be administered. Acute methamphetamine intoxication can often be handled by observation in a safe, quiet environment. In cases of extreme excitement or panic, treatment with antianxiety agents such as benzodiazepines has been helpful, and in cases of methamphetamine-induced psychoses, short-term use of neuroleptics has proven successful.

At this time the most effective treatments for methamphetamine addiction are cognitive behavioral interventions. These approaches are designed to help modify the patient’s thinking, expectancies, and behaviors, and to increase skills in coping with various life stressors. The Matrix Model, a proven effective treatment for methamphetamine addiction, consists of a 16-

week intervention that includes intensive group and individual therapy to promote the behavioral changes needed to remain off drugs, prevent relapse, and establish a new lifestyle unrelated to drugs. When applied to methamphetamine abusers, the Matrix Model has been shown to significantly reduce drug use (Figure to right). Motivational Incentives for Enhancing Drug Abuse Recovery (MIEDAR), an incentive-based method for cocaine and methamphetamine abstinence, is another treatment program that has recently demonstrated efficacy in methamphetamine abusers through NIDA’s National Drug Abuse Clinical Trials Network. Methamphetamine recovery support groups also appear to be effective adjuncts to behavioral interventions that can lead to long-term drug-free recovery.

Antidepressant medications can be helpful in combating the depressive symptoms frequently seen in newly abstinent methamphetamine users.

## Abuse of Medications for ADHD

The medications used for treatment of ADHD are primarily stimulants. While these drugs are safe and effective when used properly, they have a high potential for abuse; like other stimulants, they can lead to marked tolerance and psychological dependence, and can cause medical problems leading to serious illness or even death.

The most well known of the ADHD medications include amphetamines (e.g., Adderall®, a mix of amphetamine salts) and methylphenidate (e.g., MPH, Ritalin and Concerta—a formulation that releases medication in the body over a period of time). These medications have a paradoxically calming and “focusing” effect on individuals with ADHD. Researchers speculate that because methylphenidate, a mild central nervous stimulant, amplifies the release of dopamine, thus improving attention and focus in individuals who have dopamine signals that are weak. It also acts by activating the arousal systems in the brainstem and cortex to produce its stimulant effects. While MPH appears to target the same neuroreceptors as cocaine, it does not affect all the same components of the pleasure circuit throughout the brain.

MPH can be abused orally, or tablets can be crushed and either snorted or dissolved in water and injected. The pattern of abuse is characterized by an escalation in dose, frequent episodes of binge use followed by severe depression, and an overpowering desire to continue the use of this drug despite serious, adverse medical and social consequences. Typical of other CNS stimulants, high doses of MPH often produce agitation, tremors, euphoria, tachycardia, palpitations, and hypertension. Psychotic episodes, paranoid delusions, hallucinations, and bizarre behavioral characteristics similar to amphetamine-like toxic effects have been associated with MPH abuse.



Unlike amphetamine, methamphetamine, and cocaine, where illicit manufacturing and smuggling into the United States account for the vast majority of available drugs for abuse, pharmaceutical products diverted from legitimate channels are the only sources of MPH. It is important to note that many schools have more MPH stored for daytime dosing of students than is available in some pharmacies, and many families have supplies stored in kitchen or bathroom cabinets.

Information from DEA case files and state law enforcement services indicates that MPH is sought after by a wide range of individuals, from adolescents to street addicts. Even though the lack of clandestine production, regulatory controls, and predominant use in the treatment of ADHD in children have historically limited the illegal use of this drug, non-prescription use is on the rise. Recent reports of MPH misuse/abuse among adolescents and young adults are particularly disturbing, since this group has the freest access to this drug. Reports from numerous states and local municipalities indicate that adolescents are giving and selling their MPH medication to friends and classmates. Anecdotal reports from students and faculty on college campuses indicate that MPH is being used as a study aid in the same manner that amphetamine was used on campuses in the 1960s. Ritalin abuse is increasingly observed among elementary students, and newspaper reports suggest that it is "as easy to get as candy."

## Heroin and the Opiates

**Opiates** are powerful drugs derived from the poppy plant that have been used for centuries to relieve pain. They include opium, heroin, morphine, and codeine. Even centuries after their discovery, opiates are still the most effective pain relievers. Although heroin has no medicinal use, the other opiates, such as morphine and codeine, are used to relieve pain related to illnesses (for example, cancer) and medical and dental procedures. When used as directed by a physician, opiates are safe and generally do not produce addiction. But opiates also possess very strong reinforcing properties and can quickly trigger addiction when used improperly.

The brain produces endorphins that activate opioid receptors located throughout the brain and body. Research indicates that endorphins are involved in many functions, including respiration, nausea, vomiting, pain modulation, and hormonal regulation. Two important effects produced by the naturally occurring endorphins and opiate drugs alike are pleasure (or reward) and pain relief.

Like cocaine and other abused drugs, opiates activate the brain's reward system. Because of its chemical structure, heroin penetrates the brain more quickly than other opiates, which

is probably why many addicts prefer heroin. When a person injects, sniffs, or orally ingests heroin, the drug travels through the bloodstream, across the blood brain barrier, and into the brain. Once in the brain, heroin is rapidly converted to morphine, which then activates opiate receptors located throughout the brain, including the ventral tegmental area, nucleus accumbens and cerebral cortex within the reward system. Research suggests that stimulation of opioid receptors by morphine results in feelings of reward and activates the pleasure circuit by causing greater amounts of dopamine to be released within the nucleus accumbens. This excessive release of dopamine and over stimulation of the reward system can lead to addiction.

Opiates also act directly on the respiratory center in the brainstem causing a slowdown in activity, resulting in a decrease in respiratory rate. Excessive amounts of an opiate, like heroin, can cause the respiratory centers to shut down breathing altogether. When someone overdoses on heroin, it is the action of heroin in the brainstem respiratory centers that can cause the person to stop breathing and die.

**Heroin**, the most abused and rapidly acting of the opiates, is an illegal, highly addictive drug. It is processed from morphine, the naturally occurring substance extracted from the seedpod of certain varieties of poppy plants. It is typically sold as a white or brownish powder or as the black sticky substance known on the streets as "black tar heroin." Although purer heroin is becoming more common, most street heroin is "cut" with other drugs or with substances such as sugar, starch, powdered milk, or quinine. Street heroin can also be cut with strychnine or other poisons. Because heroin abusers do not know the actual strength of the drug or its true contents, they are at risk of overdose or death. Heroin also poses special problems because of the transmission of HIV and other diseases that can occur from sharing needles or other injection equipment.

Heroin is usually injected, sniffed/snorted, or smoked. This causes an intense euphoria, or rush, that lasts only briefly and is followed by a few hours of relaxed contentment. A typical heroin abuser may inject up to four times a day. Intravenous injection provides the greatest intensity and most rapid onset of euphoria (7 to 8 seconds), while intramuscular injection produces a relatively slow onset of euphoria (5 to 8 minutes). When heroin is sniffed or smoked, peak effects are usually felt within 10 to 15 minutes. The intensity of the rush is a function of how much drug is taken and how rapidly the drug enters the brain and binds to the natural opioid receptors. With heroin, the rush is usually accompanied by a warm flushing of the skin, dry mouth, and a heavy feeling in the extremities, and may be accompanied by nausea, vomiting, and severe itching. Although smoking and sniff-

ing heroin do not produce a "rush" as quickly or as intensely as intravenous injection, NIDA researchers have confirmed that all three forms of heroin use are addictive.

Injection continues to be the predominant method of heroin use among addicted users seeking treatment; however, researchers have observed a shift in heroin use patterns, from injection to sniffing and smoking. In fact, sniffing/snorting heroin is now the most widely reported means of taking heroin among users admitted for drug treatment in Newark, Chicago, and New York. With the shift in heroin abuse patterns comes an even more diverse group of users. Users over 30 years of age continue to be one of the largest user groups in most national data. However, younger and more affluent and discriminating users across the country are being lured by high-purity heroin, at a lower cost, that can be sniffed or smoked instead of injected.

One of the most detrimental long-term effects of heroin is addiction itself, characterized by compulsive drug seeking and use, and by neurochemical and molecular changes in the brain. Heroin also produces profound degrees of tolerance and physical dependence. As with abusers of any addictive drug, heroin abusers gradually spend more and more time and energy obtaining and using the drug. Once they are addicted, the heroin abusers' primary purpose in life becomes seeking and using drugs. Heroin literally changes their brains into drug-seeking machines.

Physical dependence develops with higher doses of the drug. With physical dependence, the body adapts to the presence of the drug and withdrawal symptoms occur if use is reduced abruptly. Withdrawal may occur within a few hours after the last time the drug is taken. Symptoms of withdrawal include restlessness, muscle and bone pain, insomnia, diarrhea, vomiting, cold flashes with goose bumps ("cold turkey"), and leg movements. Major withdrawal symptoms peak between 24 and 48 hours after the last dose of heroin and subside after about a week. However, some people have shown persistent withdrawal signs for many months. Heroin withdrawal is never fatal to otherwise healthy adults, but it can cause death to the fetus of a pregnant addict.

Physical dependence and the emergence of withdrawal symptoms were once believed to be the key features of heroin addiction. It is now known, however, that craving and relapse can occur weeks and months after withdrawal symptoms are long gone. Interestingly, patients with chronic pain who need opiates to function (sometimes over extended periods) have few if any problems forgoing opiates after their pain is resolved by other means. This may be because the patient in pain is simply seeking relief of pain and not the rush sought by the addict.

Medical consequences of chronic heroin abuse include scarred and/or collapsed veins,

bacterial infections of the blood vessels and heart valves, abscesses (boils) and other soft-tissue infections, and liver or kidney disease. Lung complications (including various types of pneumonia and tuberculosis) may result from the poor health condition of the abuser as well as from heroin's depressant effects on respiration. Many of the additives in street heroin may include substances that do not readily dissolve, thus clogging the blood vessels that lead to the lungs, liver, kidneys, or brain, and causing infection or even death of small patches of cells in vital organs. Immune reactions to these or other contaminants can cause arthritis or other rheumatologic problems. Of course, sharing of injection equipment or fluids can lead to some of the most severe consequences of heroin abuse: infections with hepatitis B and C, HIV, and a host of other blood-borne viruses, which drug abusers can then pass on to their sexual partners and children.

## Treatment

A variety of effective treatments are available for heroin addiction. Treatment tends to be more effective when heroin abuse is identified early, and detoxification is the first step. The treatments that follow vary depending on the individual, but methadone, a synthetic opiate that blocks the effects of heroin and eliminates withdrawal symptoms, has a proven record of success. Pharmaceutical approaches, like methadone, Naltrexone, Naloxone and buprenorphine are used to treat heroin addiction. There are also many effective behavioral treatments available for heroin addiction—usually in combination with medication. These can be delivered in residential or outpatient settings. Examples are individual or group counseling; contingency management, which uses a voucher-based system where patients earn “points” based on negative drug tests—these points can be exchanged for items that encourage healthy living; and cognitive-behavioral therapy, designed to help modify a patient's expectations and behaviors related to drug abuse, and to increase skills in coping with various life stressors.

## Detoxification

The primary objective of detoxification is to relieve withdrawal symptoms while patients adjust to a drug-free state. Not in itself a treatment for addiction, detoxification is a useful step only when it leads into long-term treatment that is either drug-free (residential or outpatient) or uses medications as part of the treatment. The best documented drug-free treatments are the therapeutic community residential programs lasting at least 3 to 6 months.

## Treatment programs

Methadone treatment has been used effectively and safely to treat opioid addiction for more than

30 years. Properly prescribed methadone is not intoxicating or sedating, and its effects do not interfere with ordinary activities such as driving a car. The medication is taken orally, once a day, and it suppresses narcotic withdrawal for 24 to 36 hours. Patients on methadone remain able to perceive pain and have emotional reactions. Most important, methadone relieves the craving associated with heroin addiction; craving is a major reason for relapse. Among methadone patients, it has been found that normal street doses of heroin are ineffective at producing euphoria, thus making the use of heroin more easily extinguishable.

Also, methadone is medically safe even when used continuously for 10 years or more. Combined with behavioral therapies or counseling and other supportive services, methadone enables patients to stop using heroin (and other opiates) and return to more stable and productive lives. Methadone dosages must be carefully monitored in patients who are receiving antiviral therapy for HIV infection, however, to avoid potential medication interactions.

## Other Medications

*Buprenorphine* is a more recently approved treatment for heroin addiction (and other opiates). Compared with methadone, buprenorphine produces less risk for overdose and withdrawal effects and produces a lower level of physical dependence, so patients who discontinue the medication generally have fewer withdrawal symptoms than those who stop taking methadone. The development of buprenorphine and its authorized use in physicians' offices give opiate-addicted patients more medical options and extend the reach of addiction medication. Its accessibility may even prompt attempts to obtain treatment earlier. However, not all patients respond to buprenorphine—some continue to require treatment with methadone.

*Naltrexone (Trexan)* is approved for treating heroin addiction but has not been widely utilized due to poor patient compliance. This medication blocks opioids from binding to their receptors and thus prevents an addicted individual from feeling the effects of the drug. Naltrexone as a treatment for opioid addiction is usually prescribed in outpatient medical settings, although initiation of the treatment often begins after medical detoxification in a residential setting. To prevent withdrawal symptoms, individuals must be medically detoxified and opioid-free for several days before taking naltrexone. Naltrexone has also been found to be successful in preventing relapse by former opiate addicts released from prison on parole.

*Naloxone (Narcan)* is a shorter-acting opioid receptor blocker, used to treat cases of overdose. As opiate antagonists, they are especially useful as antidotes.

For pregnant heroin abusers, methadone

maintenance combined with prenatal care and a comprehensive drug treatment program can improve many of the detrimental maternal and neonatal outcomes associated with untreated heroin abuse. Preliminary evidence suggests that buprenorphine may also be a safe and effective treatment during pregnancy, although infants exposed to either methadone or buprenorphine prenatally may still require treatment for withdrawal symptoms. For women who do not want or are not able to receive pharmacotherapy for their heroin addiction, detoxification from opiates during pregnancy can be accomplished with medical supervision, although potential risks to the fetus and the likelihood of relapse to heroin use should be considered.

Other medications with potential for treating heroin overdose/addiction are currently under investigation by NIDA.

## Behavioral therapies

Although behavioral and pharmacologic treatments can be extremely useful when employed alone, integrating both types of treatments will ultimately be most effective. There are many behavioral treatments available for heroin addiction in both residential and outpatient settings: the important task is to match the treatment approach to the particular needs of the patient. Contingency management therapy, for example, uses a voucher-based system, where patients earn points based on negative drug tests that they can exchange for items that encourage healthy living. Cognitive-behavioral interventions are designed to help modify the patient's thinking, expectations, and behaviors and to increase skills in coping with various life stressors. Both behavioral and pharmacological treatments help to restore a degree of normalcy to brain function and behavior, with increased employment rates and lower risk of HIV and other diseases and criminal behavior.

## Opioid Analogs and Relatives

Drug analogs are chemical compounds that are similar to other drugs in their effects but differ slightly in their chemical structure. Some analogs are produced by pharmaceutical companies for legitimate medical reasons. Other analogs, sometimes referred to as “designer” drugs, can be produced in illegal laboratories and are often more dangerous and potent than the original drug. Two of the most commonly known opioid analogs are fentanyl and meperidine (Demerol).

Fentanyl was introduced under the brand name “Sublimaze” in 1968 by a Belgian pharmaceutical company as a synthetic narcotic to be used as an analgesic in surgical procedures because of its minimal effects on the heart. Soon thereafter, an analog version called China White began to appear: users ended up in emergency rooms with classic overdose symptoms that responded to opiate antagonists like Narcan, but there were

no traces of opiates in their symptoms. Fentanyl is particularly dangerous because it is 50 times more potent than heroin and can rapidly stop respiration. This is not a problem during surgical procedures because machines are used to help patients breathe. On the street, however, users have been found dead with the needle used to inject the drug still in their arms.

A particularly tragic story is associated with attempts to create an effective analog of Demerol for street use. The substance, called MPTP after its molecular components, turned out to be a potent neurotoxin, producing a serious and irreversible Parkinson's-like syndrome in users. Despite all treatment efforts, most of those affected remain unable to move or speak.

A semisynthetic narcotic, oxycodone (Percodan), has been widely used for years, often in combination with aspirin or acetaminophen. Synthesized from thebaine, an opium derivative, it is more potent than codeine and has a higher dependence potential. Street use was limited due to its tendency to make the user's ears ring. Recently, a time-release version of the venerable Percodan was introduced; OxyContin, as it is called, was widely heralded as a significant improvement over available palliative medications, because its time-release mechanism afforded significant, sustained relief for people in severe pain. It has been prescribed primarily for patients diagnosed with terminal cancer, recovering from major surgery, or suffering from debilitating migraine headaches.

Unfortunately, street users of the drug, attracted to its euphoric high that is similar to that of heroin, have created an epidemic of OxyContin abuse. The pills are crushed into powder to overcome the sustained release; the drug is then snorted or diluted and injected into the user's veins. Dosage control is thus minimal, and hundreds of people have died from overdose.

## Hallucinogens

Hallucinogens are drugs that cause hallucinations – altered states of perception and profound distortions of reality. They can cause users to hear voices, see images, and feel sensations that do not exist; they also can produce rapid, intense emotional swings. Hallucinogenic drugs have played a role in human life for thousands of years. Cultures from the tropics to the arctic have used plants to induce states of detachment from reality and to precipitate “visions” thought to provide mystical insight. Historically, hallucinogenic plants were used largely for social and religious ritual, and their availability was limited by the climate and soil conditions they require. After the development of LSD, a synthetic compound that can be manufactured anywhere, abuse of hallucinogens became more widespread, and from the 1960s it increased dramatically. All LSD manufactured in this country is intended for illegal use, since LSD has no accepted medical

use in the United States.

Hallucinogens include natural substances, such as mescaline and psilocybin that come from plants (cactus and mushrooms, respectively), and chemically manufactured ones, such as LSD and MDMA (ecstasy). LSD is manufactured from lysergic acid, which is found in ergot, a fungus that grows on rye and other grains. MDMA is a synthetic mind-altering drug with hallucinogenic properties. Although not a true hallucinogen in the pharmacological sense, PCP causes many of the same effects as hallucinogens and so is often included with this group of drugs.

Hallucinogens disrupt the interaction of nerve cells and the neurotransmitter serotonin. Distributed throughout the brain and spinal cord, the serotonin system is involved in the control of behavioral, perceptual, and regulatory systems, including mood, hunger, body temperature, sexual behavior, muscle control, and sensory perception. Researchers are not certain that brain chemistry permanently changes from hallucinogen use, but some people who use them appear to develop chronic mental disorders. PCP and MDMA are both addicting, whereas LSD, psilocybin, and mescaline are not.

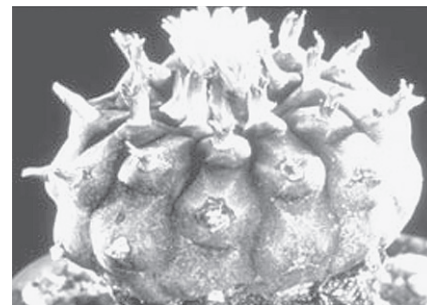
## LSD

**LSD** (an abbreviation of the German words for “lysergic acid diethylamide”) is the drug most commonly identified with the term “hallucinogen” and the most widely used in this class of drugs. LSD, also familiar as “acid,” is a clear or white, odorless, water-soluble material synthesized from lysergic acid, a compound derived from a rye fungus. LSD is the most potent mood- and perception-altering drug known: oral doses as small as 30 micrograms can produce effects that last 6 to 12 hours.

LSD is initially produced in crystalline form. The pure crystal can then be crushed to powder and mixed with binding agents to produce tablets known as “microdots” or thin squares of gelatin called “window panes”; more commonly, it is dissolved, diluted, and applied to paper or other materials. The most common form of LSD is called “blotter acid” – sheets of paper soaked in LSD and perforated into 1/4-inch square individual dosage units. Variations in manufacturing and the presence of contaminants can produce LSD in colors ranging from clear or white, in its purest form, to tan or even black. Even uncontaminated LSD begins to degrade and discolor soon after it is manufactured, and drug distributors often apply LSD to colored paper, making it difficult for a buyer to determine the drug's purity or age.

LSD's effects typically begin within 30 to 90 minutes after ingestion and may last as long as 12 hours. Users refer to LSD and other hallucinogenic experiences as “trips” and to the acute adverse experiences as “bad trips;” the drug's effects are unpredictable and may vary with the amount ingested and the user's personality,

## Cactus...



## Source of Mescaline

mood, expectations, and surroundings. Users of LSD may experience some physiological effects, such as increased blood pressure and heart rate, dizziness, loss of appetite, dry mouth, sweating, nausea, numbness, and tremors; but the drug's major effects are emotional and sensory. The user's emotions may shift rapidly through a range from fear to euphoria, with transitions so rapid that the user may seem to experience several emotions simultaneously.

LSD also has dramatic effects on the senses. Colors, smells, sounds, and other sensations seem highly intensified. In some cases, sensory perceptions may blend in a phenomenon known as synesthesia, in which a person seems to hear or feel colors and see sounds. Hallucinations distort or transform shapes and movements, and they may give rise to a perception that time is moving very slowly or that the user's body is changing shape. On some “trips”, users experience sensations that are enjoyable and mentally stimulating and that produce a sense of heightened understanding. Bad trips, however, include terrifying thoughts and nightmarish feelings of anxiety and despair that include fears of insanity, death, or losing control.

## Mushrooms...



## Source of Psilocybin



## Street Names for Hallucinogens and Dissociative Drugs

### LSD

- acid
- blotter
- dots
- microdot
- pane
- paper acid
- sugar
- sugar cubes
- trip
- window glass
- window pane
- zen

### Ketamine

- bump
- cat Valium
- green
- honey oil
- jet
- K
- purple
- special K
- special la coke
- super acid
- super C
- vitamin K

### PCP

- angel
- angel dust
- boat
- dummy dust
- love boat
- peace
- supergrass
- zombie

### Datura

- nightshade
- angel trumpet
- CIA drug
- jimsonweed

LSD users quickly develop a high degree of tolerance for the drug's effects: after repeated use, they need increasingly larger doses to produce similar effects. LSD use also produces tolerance for other hallucinogenic drugs such as psilocybin and mescaline, but not for drugs such as marijuana, amphetamines, and PCP, which do not act directly on the same serotonin receptors affected by LSD. Tolerance for LSD is lost if the user stops taking the drug for several days, and there is no evidence that LSD produces physical withdrawal symptoms when chronic use is stopped.

Long-term effects of LSD use can include persistent psychosis and hallucinogen persisting perception disorder (HPPD), more commonly referred to as "flashbacks." The causes of these effects, which in some users occur after a single experience with the drug, are not known. The acute effects of LSD can be described as drug-induced psychosis: a distortion or disorganization of a person's capacity to recognize reality, think rationally, or communicate with others. Some LSD users experience devastating psychological effects that persist after the trip has ended, however, producing a long-lasting psychotic-like state. LSD-induced persistent psychosis may include dramatic mood swings from mania to profound depression, vivid visual disturbances, and hallucinations. These effects may last for years and can affect people who have no history or other symptoms of psychological disorder.

Other former LSD users report experiences known colloquially as "flashbacks" and called "HPPD" by physicians. These episodes are spontaneous, repeated, sometimes continuous recurrences of some of the sensory distortions originally produced by LSD. The experience may include hallucinations, but it most commonly consists of visual disturbances such as seeing false motion on the edges of the field of vision, bright or colored flashes, and halos or trails attached to moving objects. This condition is typically persistent and in some cases remains unchanged for years after individuals have stopped using the drug. Because HPPD symptoms may be mistaken for those of other neurological disorders such as stroke or brain tumors, sufferers may consult a variety of clinicians before the disorder is accurately diagnosed. There is no established treatment for HPPD, although some antidepressant drugs may reduce the symptoms. Psychotherapy may help patients adjust to the confusion associated with visual distraction and to minimize the fear, expressed by some, that they are suffering from ongoing brain damage or psychiatric disorder.

The precise mechanism by which LSD alters perceptions is still unclear. Evidence from laboratory studies suggest that LSD, like the hallucinogenic plants, binds to and activates certain groups of serotonin receptors designated the 5-HT<sub>2</sub> receptors. Normally, serotonin binds to

and activates its receptors and then is taken back up into the neuron that released it. In contrast, LSD binds very tightly to the serotonin receptor, causing a greater than normal activation of the receptor. LSD's effects are most prominent in two brain regions: the cerebral cortex, an area involved in mood, cognition, and perception; and the locus ceruleus, which receives sensory signals from all areas of the body and has been described as the brain's "novelty detector" for important external stimuli.

## PCP and Other Dissociative Drugs

### PCP

PCP (phencyclidine), developed in the 1950s as an intravenous surgical anesthetic, is classified as a dissociative drug rather than a true hallucinogen: its sedative and anesthetic effects are trance-like, and patients experience a feeling of being "out of body" and detached from their environment. At low to moderate doses, PCP causes altered perception of body image, but rarely produces visual hallucinations. PCP can also create effects that mimic the primary symptoms of schizophrenia, such as delusions and mental turmoil.

PCP was used in veterinary medicine but was never approved for human use because of problems that arose during clinical studies, including delirium and extreme agitation experienced by patients emerging from anesthesia. Over the years PCP has developed a reputation as a dynamite drug, for its ability to transform an otherwise docile person into a raging maniac, explosive and extremely dangerous. In a study of 1000 episodes of PCP intoxication, unpredictable outbursts leading to shootings, stabbings, grotesque murders, and self-inflicted injuries occurred in 35% of the cases. Another 32% of the users displayed bizarre behaviors, including wandering about nude in public, lying down in the middle of a busy street, or driving 10 mph on the freeway.

During the 1960s, PCP in pill form became widely abused, but the surge in illicit use receded rapidly as users became dissatisfied with the long delay between taking the drug and feeling its effects, and with the unpredictable and often violent behavior associated with its use. Powdered PCP – known as "ozone," "rocket fuel," "love boat," "hog," "embalming fluid," or "superweed" – appeared in the 1970s. In powdered form, the drug is sprinkled on marijuana, tobacco, or parsley, then smoked, and the onset of effects is rapid. Users sometimes ingest PCP by snorting the powder. Normally a white crystalline powder, PCP is sometimes colored with water-soluble or alcohol-soluble dyes.

When snorted or smoked, PCP rapidly passes to the brain to disrupt the functioning of sites

known as NMDA (N-methyl-D-aspartate) receptor complexes, which are receptors for the neurotransmitter glutamate. Glutamate receptors play a major role in the perception of pain; in cognition, including learning and memory; and in emotion. In the brain, PCP also alters the actions of dopamine, a neurotransmitter responsible for the euphoria and “rush” associated with many abused drugs. PCP’s effects are unpredictable. Typically, they are felt within minutes of ingestion and last for several hours, but some users report feeling the drug’s effects for days. One drug-taking episode may produce feelings of detachment from reality, including distortions of space, time, and body image; another may produce hallucinations, panic, and fear. Some users report feelings of invulnerability and exaggerated strength. PCP users may become severely disoriented, violent, or suicidal.

At low PCP doses (5 mg or less), physical effects include shallow, rapid breathing, increased blood pressure and heart rate, and elevated temperature. Doses of 10 mg or more can cause dangerous changes in blood pressure, heart rate, and respiration, often accompanied by nausea, blurred vision, dizziness, and decreased awareness of pain. Muscle contractions may cause uncoordinated movements and bizarre postures. When severe, the muscle contractions can result in bone fracture or in kidney damage or failure as a consequence of muscle cells breaking down. Very high doses of PCP can cause convulsions, coma, hyperthermia, and death. Repeated use of PCP can result in addiction, and recent research suggests that repeated or prolonged use of PCP can cause withdrawal syndrome when drug use is stopped. Symptoms such as memory loss, speech problems, and depression may persist for as long as a year after a chronic user stops taking PCP.

## Ketamine

(“K,” “Special K,” “cat Valium”) is another dissociative anesthetic. It was developed in 1963 to replace PCP and is currently manufactured as an injectable liquid to be used in human anesthesia and veterinary medicine. Much of the ketamine sold on the street has been diverted from veterinarians’ offices. In illicit use ketamine is generally evaporated to form a powder that is snorted, smoked with marijuana or tobacco products, or compressed into pills. In some cities (Boston, New Orleans, and Minneapolis/St. Paul, for example), ketamine is reportedly being injected intramuscularly.

Ketamine’s chemical structure and mechanism of action are similar to those of PCP, and its effects are similar, but ketamine is much less potent than PCP with effects of much shorter duration. Users report sensations ranging from a pleasant feeling of floating to being separated from their bodies. Some ketamine experiences involve a terrifying feeling of almost complete sensory detachment that is likened to a near-

death experience. These experiences, similar to a “bad trip” on LSD, are called the “K-hole.” Low-dose intoxication from ketamine results in impaired attention, learning ability, and memory. At higher doses, ketamine can cause delirium, amnesia, impaired motor function, high blood pressure, depression, and potentially fatal respiratory problems.

Ketamine is odorless and tasteless, so it can be added to beverages without being detected, and it induces amnesia. Because of these properties, the drug is sometimes given to unsuspecting victims and used in the commission of sexual assaults referred to as “drug rape.”

## Club Drugs

“Club drugs” is a collective term for some very dangerous substances that are increasingly popular among young adults who attend all-night dance parties called raves or trances, dance clubs, and bars. Included in the term are a wide variety of drugs with a wide variety of sources, pharmacological agents, and potential contaminants, making it difficult to predict toxicity, symptoms, and consequences of use. In this category along with methamphetamine and the hallucinogens LSD and ketamine, are MDMA, the CNS depressant GHB, and the benzodiazepine Rohypnol.

## MDMA

(Ecstasy) is a synthetic, psychoactive drug with both stimulant and hallucinogenic properties. Other street names for MDMA include Adam, XTC, hug, beans, and love drug. MDMA was first synthesized and patented in 1914 by Merck, a German drug company, for use as an appetite suppressant but was never marketed. In the 1970s, the drug was given to psychotherapy patients because it helped them open up and talk about their feelings. This practice was stopped in 1986 when animal studies showed that Ecstasy could cause brain damage. Ecstasy gained national attention during the 1980s when it was touted as the new LSD, and now is widely considered the drug of choice at club parties.

MDMA is usually taken orally in tablet or capsule form. Its effects last approximately 3 to 6 hours, though confusion, depression, sleep problems, anxiety, and paranoia have been reported to occur weeks after the drug is taken. MDMA can produce a significant increase in heart rate and blood pressure and a sense of alertness like that associated with amphetamine use. The stimulant effects of MDMA, which enable users to dance for extended periods, may also lead to dehydration, hypertension, and heart or kidney failure.

Users report that Ecstasy lowers their inhibitions and relaxes them. MDMA is also said to increase awareness and feelings of pleasure and to give people energy. Unlike the drug LSD, low doses of MDMA do not cause people to

hallucinate. However, some people report side effects after taking MDMA such as headaches, chills, eye twitching, jaw clenching, blurred vision and nausea. MDMA can cause confusion, hallucinations, depression, sleep problems, drug craving, severe anxiety, and paranoia. In addition, in high doses it can cause a sharp increase in body temperature (malignant hyperthermia) leading to muscle breakdown and kidney and cardiovascular system failure.

Recent data suggest that MDMA may be toxic to the brain. Its chemical structure (3-4 methylenedioxymethamphetamine, “MDMA”) is similar to methamphetamine, methylenedioxymethamphetamine (MDA), and mescaline. Like the hallucinogens, MDMA causes serotonin to be released from neurons in greater amounts than normal. Once released, this serotonin can excessively activate serotonin receptors. Scientists have shown that MDMA causes excess dopamine to be released from dopamine-containing neurons as well. Particularly alarming is research in animals that has demonstrated that MDMA can damage and destroy serotonin containing neurons. A recent study of the brain scans of people who had used Ecstasy an average of 200 times over five years found visible brain damage, although the behavior of these people appeared normal; in fact, those who used the drug more often had more brain damage than less frequent users. Positron emission tomography (PET) demonstrated a 20-60% reduction in healthy serotonin cells in the drug users, potentially limiting their abilities to remember and to learn. Given the widespread role of serotonin as a neurotransmitter, additional studies are being conducted to gauge Ecstasy’s effect on mood, memory, cognition, and behaviors such as eating and sleeping.

## GHB

GHB (Gamma hydroxybutyrate, “Xyrem”) is a central nervous system depressant that can relax or sedate the body. It was approved by the FDA for the treatment of narcolepsy with severe restrictions and patient registry monitoring.

Street names for the drug include Grievous Bodily Harm, G, Liquid Ecstasy, and Georgia Home Boy. It is usually abused either for its intoxicating/sedative/ euphoric properties or for its growth hormone-releasing effects, which can build muscles. GHB can be produced in clear liquid, white powder, tablet, and capsule forms, and it is often used in combination with alcohol, making it even more dangerous. GHB is often manufactured in homes with recipes and ingredients found and purchased on the Internet; these ingredients are found in a number of dietary supplements available in health food stores and gymnasiums to induce sleep, build muscles, and enhance sexual performance.

The drug is used predominantly by adolescents and young adults, often when they attend

nightclubs and raves. GHB's intoxicating effects begin 10 to 20 minutes after the drug is taken, and typically last up to 4 hours, depending on the dosage. At lower doses, GHB can relieve anxiety and produce relaxation; however, as the dose increases, the sedative effects may result in sleep and eventual coma or death. Overdose of GHB can occur rather quickly, and the signs are similar to those of other sedatives: drowsiness, nausea, vomiting, headache, loss of consciousness, loss of reflexes, and impaired breathing. GHB is cleared from the body relatively quickly, so it is sometimes difficult to detect in emergency rooms and other treatment facilities. GHB has been increasingly involved in poisonings, overdoses, "date rapes," and fatalities.

## Rohypnol

Rohypnol (flunitrazepam) belongs to the class of drugs known as benzodiazepines. It is not approved for prescription use in the United States and its importation is banned. It is approved in Europe and used in more than 60 countries as a treatment for insomnia, as a sedative, and as a pre-surgery anesthetic.

Street names for the drug include Roofies, Rophies, Roche, and the Forget-Me Pill. It is usually taken orally, although there are reports that it can be ground up and snorted. Rohypnol is tasteless and odorless, and it dissolves easily in carbonated beverages. The sedative and toxic effects are aggravated by concurrent use of alcohol but, even without alcohol, a dose of Rohypnol as small as 1 mg can impair a victim for 8 to 12 hours.

Adverse effects associated with Rohypnol include decreased blood pressure, drowsiness, visual disturbances, dizziness, confusion, gastrointestinal disturbances, and urinary retention. The drug can cause profound anterograde amnesia, so that individuals may not remember events they experienced while under the effects of the drug. This may be why one of the street names for Rohypnol is "the forget-me pill," and it reportedly has been used in sexual assaults.

## Date Rape Drugs

According to the American Academy of Experts in Traumatic Stress, there continues to be an escalating problem of drug-assisted rape. This increase in prevalence and incidence led to the passage of the Drug-induced Rape Prevention and Punishment Act (1996). This law provides for up to 20 years in prison and fines for anyone who intends to commit a violent crime by covertly distributing a controlled substance to an unknowing individual.

Other substances historically associated with drug-assisted rape include amphetamines, barbiturates, opiates, and chloral hydrate and alcohol - a "Mickey Finn."

Current substances now commonly used as "knockout" drugs that may render a woman inca-

pable of resisting an attack are GHB, Rohypnol, Ketamine, and Datura. Datura is an anticholinergic and hallucinogenic substance made of refined scopolamine. It is used for motion sickness and as an adjunct to anesthesia, producing sedation and amnesia. Onset is within 15-30 minutes, with effects lasting up to 2-3 days. Once ingested or inhaled one experiences submissive behavior, hypnosis, hallucinations and confusion. Serious side effects include an anticholinergic syndrome leading to coma, seizures and death. Treatment of overdose includes airway management and administration of physostigmine for severe anticholinergic effects.

## Inhalants

Inhalants are volatile substances that produce chemical vapors that can be inhaled to induce a psychoactive, or mind-altering, effect. Although other abused substances can be inhaled, the term "inhalants" is used to describe a variety of substances whose main common characteristic is that they are rarely, if ever, taken by any route other than inhalation. This definition encompasses a broad range of chemicals found in hundreds of different products that may have different pharmacological effects. (Figure 3 on the following page) As a result, precise categorization of inhalants is difficult. One classification system lists four general categories of inhalants, volatile solvents, aerosol, gases, and nitrites, based on the form in which they are often found in household, industrial, and medical products.

**Volatile solvents** are liquids that vaporize at room temperatures. They are found in a multitude of inexpensive, easily available products used for common household and industrial purposes. These include paint thinners and removers, dry-cleaning fluids, degreasers, gasoline, glues, correction fluids, and felt-tip marker fluids.

**Aerosols** are sprays that contain propellants and solvents. They include spray paints, deodorants and hair sprays, vegetable oil sprays for cooking, and fabric protector sprays.

**Gases** include medical anesthetics as well as gases used in household or commercial products. Medical anesthetic gases include ether, chloroform, halothane, and nitrous oxide, commonly called "laughing gas." Nitrous oxide is the most abused of these gases and can be found in whipped cream dispensers and products that boost octane levels in racing cars. Household or commercial products containing gases also include butane lighters, propane tanks, and refrigerants.

**Nitrites** often are considered a special class of inhalants. Unlike most other inhalants, which act directly on the central nervous system, nitrites act primarily to dilate blood vessels and relax the muscles. And while other inhalants are used to alter mood, nitrites are used primarily as sexual enhancers. Nitrites include cyclohexyl nitrite, isoamyl (amyl) nitrite, and isobutyl (butyl) ni-

trite. Cyclohexyl nitrite is found in room deodorizers. Amyl nitrite is used in certain diagnostic procedures and is prescribed to some patients for heart pain. Illegally diverted ampules of amyl nitrite are called "poppers" or "snappers" on the street. Butyl nitrite is an illegal substance that is often packaged and sold in small bottles also referred to as "poppers."

**Inhalants**, particularly volatile solvents, gases, and aerosols, are often among the first drugs that young children use. They also are one of the few substances abused more by younger children than by older ones. One national survey indicates that about 6 percent of U.S. children have tried inhalants by the time they reach fourth grade. Current statistics revealed lifetime use of inhalants was reported by 14.9 percent of 8th-graders, 12.3 percent of 10th-graders, and 9.5 percent of 12th-graders in 2009.

Investigators are concerned that perceived risk associated with inhalant use has been in decline for several years, which may leave young people open to renewed interest. Abuse can also become chronic and extend into adulthood.

Generally, inhalant abusers will abuse any available substance. However, effects produced by individual inhalants vary, and some individuals will go out of their way to obtain their favorite inhalant. For example, in certain parts of the country, "Texas shoe-shine," a shoe-shining spray containing the chemical toluene, is a local favorite. Silver and gold spray paints, which contain more toluene than other spray colors, also are popular inhalants.

Data from national and state surveys suggests inhalant abuse reaches its peak at some point during the seventh through ninth grades. Gender differences in inhalant abuse have been identified at different points in childhood. One study indicates inhalant abuse is higher for boys than girls in grades 4 through 6, occurs at similar rates in grades 7 through 9, when overall use is highest, and becomes more prevalent again among boys in grades 10 through 12. People who abuse inhalants are found in both urban and rural settings. Research on factors contributing to inhalant abuse suggests that adverse socioeconomic conditions, rather than racial or cultural factors per se, may account for most reported racial and ethnic differences in rates of inhalant abuse. Poverty, a history of childhood abuse, poor grades, and dropping out of school all are associated with inhalant abuse.

Inhalants can be breathed in through the nose or the mouth in a variety of ways, such as:

- ◆ "Sniffing" or "snorting" fumes from containers;
- ◆ Spraying aerosols directly into the nose or mouth;
- ◆ "Bagging" or sniffing or inhaling fumes from substances sprayed or



## Complications of Commonly Abused Inhalants

### amyl nitrite, butyl nitrite

("poppers," "video head cleaner")  
sudden sniffing death syndrome, suppressed immunologic function, injury to red blood cells (interfering with oxygen supply to vital tissues)

**benzene** (found in gasoline)  
bone marrow injury, impaired immunologic function, increased risk of leukemia, reproductive system toxicity

**butane, propane**  
(found in lighter fluid, hair and paint sprays)  
sudden sniffing death syndrome via cardiac effects, serious burn injuries (because of flammability)

**freon** (used as a refrigerant and aerosol propellant)  
sudden sniffing death syndrome, respiratory obstruction and death (from sudden cooling/cold injury to airways), liver damage

### methylene chloride

(found in paint thinners and removers, degreasers)  
reduction of oxygen-carrying capacity of blood, changes to the heart muscle and heartbeat

**nitrous oxide** ("laughing gas"), **hexane**  
death from lack of oxygen to the brain, altered perception and motor coordination, loss of sensation, limb spasms, blackouts caused by blood pressure changes, depression of heart muscle functioning

**toluene**  
(found in gasoline, paint thinners and removers, correction fluid)  
brain damage (loss of brain tissue mass, impaired cognition, gait disturbances, loss of coordination, loss of equilibrium, limb spasm hearing and vision loss), liver and kidney damage

**trichloroethylene**  
(found in spot removers, degreasers)  
sudden sniffing death syndrome, cirrhosis of the liver, reproductive complications, hearing and vision damage

Figure 3

- deposited inside a plastic or paper bag;
- ♦ "Huffing" from an inhalant-soaked rag stuffed in the mouth; and
- ♦ Inhaling from balloons filled with nitrous oxide.

Inhaled chemicals are rapidly absorbed through the lungs into the bloodstream and quickly distributed to the brain and other organs. Within minutes of inhalation, the user experiences intoxication along with other effects similar to those produced by alcohol. Alcohol-like effects may include slurred speech, an inability to coordinate movements, euphoria, and dizziness. In addition, users may experience lightheadedness, hallucinations, and delusions, such as thinking they can fly. Because intoxication lasts only a few minutes, abusers frequently seek to prolong the high by continuing to inhale repeatedly over the course of several hours, a very dangerous practice. With successive inhalations, abusers can suffer loss of consciousness and death. At the least, they will feel less inhibited and less in control. After heavy use of inhalants, abusers may feel drowsy for several hours and experience a lingering headache.

Many brain systems may be involved in the anesthetic, intoxicating, and reinforcing effects of different inhalants. Nearly all abused inhalants (other than nitrites) produce a pleasurable effect

by depressing the CNS. Evidence from animal studies suggests that a number of commonly abused volatile solvents and anesthetic gases have neurobehavioral effects and mechanisms of action similar to those produced by CNS depressants, which include alcohol and medications such as sedatives and anesthetics. A recent study indicates that toluene, a solvent found in many commonly abused inhalants including airplane glue, paint sprays, and paint and nail polish removers, activates the brain's dopamine system. The dopamine system has been shown to play a role in the rewarding effects of many drugs of abuse. Nitrites, in contrast, dilate and relax blood vessels rather than acting as anesthetic agents.

The chemicals found in solvents, aerosol sprays, and gases can produce a variety of additional effects during or shortly after use. These effects are related to inhalant intoxication and may include belligerence, apathy, impaired judgment, and impaired functioning in work or social situations. Dizziness, drowsiness, slurred speech, lethargy, depressed reflexes, general muscle weakness, and stupor are other possible effects. For example, research shows that toluene can produce headache, euphoria, giddy feelings, and inability to coordinate movements. Exposure to high doses can cause confusion and delirium. Nausea and vomiting are other common side effects.

Inhaled nitrites dilate blood vessels, increase heart rate, and produce a sensation of heat and excitement that can last for several minutes. Other effects can include flush, dizziness, and headache.

A strong desire to continue using inhalants has been reported among many individuals, particularly those who abuse inhalants for prolonged periods over many days. Compulsive use and a mild withdrawal syndrome can occur with long-term inhalant abuse. Additional symptoms exhibited by long-term inhalant abusers include weight loss, muscle weakness, disorientation, inattentiveness, lack of coordination, irritability, and depression.

Inhalant abusers risk an array of devastating medical consequences. Prolonged sniffing of the highly concentrated chemicals in solvents or aerosol sprays can induce irregular and rapid heart rhythms and lead to heart failure and death within minutes of a session of prolonged sniffing. This syndrome, known as "sudden sniffing death," can result from a single session of inhalant use by an otherwise healthy young person.

Sudden sniffing death is particularly associated with the abuse of butane, propane, and chemicals in aerosols. Inhalant abuse also can cause death by:

- ♦ Asphyxiation from repeated inhalations, which lead to high concentrations of inhaled fumes displacing the available oxygen in the lungs;
- ♦ Suffocation from blocking air from entering the lungs when inhaling fumes from a plastic bag placed over the head;
- ♦ Choking from inhalation of vomit after inhalant use; or
- ♦ Fatal injury from accidents, including motor vehicle fatalities, suffered while intoxicated.

Both animal research and human pathological studies indicate that chronic abuse of volatile solvents such as toluene damages the protective sheath around certain nerve fibers in the brain and peripheral nervous system. This extensive destruction of nerve fibers is clinically similar to that seen with neurological diseases such as multiple sclerosis. The neurotoxic effects of prolonged inhalant abuse include damage to parts of the brain involved in controlling cognition, movement, vision, and hearing. Cognitive abnormalities can range from mild impairment to severe dementia. Other effects can include difficulty coordinating movement, spasticity, and loss of feeling, hearing, and vision.

Inhalants also are highly toxic to other organs. Chronic exposure can produce significant damage to the heart, lungs, liver, and kidneys. Although some inhalant-induced damage to the nervous and other organ systems may be at least partially reversible when inhalant abuse is

stopped, many syndromes caused by repeated or prolonged abuse are irreversible.

Abuse of inhalants during pregnancy may place infants and children at increased risk of developmental problems. Animal studies designed to simulate human patterns of inhalant abuse suggest that prenatal exposure to toluene or trichloroethylene (TCE) can result in reduced birth weight, skeletal abnormalities, and delayed neurobehavioral development. A number of case reports note abnormalities in newborns of mothers who chronically abuse solvents, and there is evidence of subsequent developmental impairment in some of these children.

However, no well-controlled, prospective study of the effects of prenatal exposure to inhalants in humans has been conducted, and it is not possible to link prenatal exposure of a specific chemical to a specific birth defect or developmental problem.

As noted previously, nitrites are mainly abused by older adolescents and adults, typically to enhance sexual function and pleasure. Research shows that abuse of these drugs in this context is associated with unsafe sexual practices that greatly increase the risk of contracting and spreading such infectious diseases as HIV/AIDS and hepatitis. Recent research also raises the possibility that there may be a link between abuse of nitrite inhalants and the development and progression of infectious diseases and tumors. The research indicates that inhaling nitrites depletes many cells in the immune system and impairs immune system mechanisms that fight infectious diseases. A recent study found that even a relatively small number of exposures to butyl nitrite can produce dramatic increases in tumor incidence and growth rates in animals.

## Steroids

"Anabolic steroids" is the familiar name for synthetic substances related to the male sex hormones (androgens). They promote the growth of skeletal muscle (anabolic effects) and the development of male sexual characteristics (androgenic effects), among other effects. Anabolic steroids were developed in the late 1930s primarily to treat hypogonadism, a condition in which the testes do not produce sufficient testosterone for normal growth, development, and sexual functioning. The primary medical uses of these compounds are to treat delayed puberty, some types of impotence, and wasting of the body caused by HIV infection or other diseases.

During the 1930s, scientists discovered that anabolic steroids could facilitate the growth of skeletal muscle in laboratory animals, which led to use of the compounds first by bodybuilders and weightlifters and then by athletes in other sports. Steroid abuse has become so widespread in athletics that it often affects the outcome of sports contests. More than 100 different anabolic steroids have been developed, but they require

a prescription to be used legally in the United States. Most steroids that are used illegally are smuggled in from other countries, illegally diverted from U.S. pharmacies, or synthesized in clandestine laboratories.

In the United States, supplements such as DHEA (dehydroepiandrosterone) and Andro (androstenedione) can be purchased legally without a prescription through many commercial sources including health food stores. They are often referred to as dietary supplements, although they are not food products. They are often taken because the user believes they have muscle-building effects.

Steroidal supplements can be converted into testosterone or a similar compound in the body. Whether such conversion produces sufficient quantities of testosterone to promote muscle growth or whether the supplements themselves promote muscle growth is unknown. Recent evidence suggests that steroid abuse among adolescents is on the rise. It has been estimated that hundreds of thousands of people aged 18 and older abuse anabolic steroids at least once a year. Among both adolescents and adults, steroid abuse is higher among males than females. However, steroid abuse is growing most rapidly among young women.

Two of the main reasons people give for abusing steroids is to enhance sports performance and improve physical appearance. Among competitive bodybuilders, steroid abuse has been estimated to be very high. Among other athletes, the incidence of abuse probably varies depending on the specific sport. Another reason people give for taking steroids is to increase their muscle size and/or reduce their body fat. This group includes some people who have a behavioral syndrome (muscle dysmorphia) in which a person has a distorted image of his or her body. Men with this condition think that they look small and weak, even if they are large and muscular. Similarly, women with the syndrome think that they look fat and flabby, even though they are actually lean and muscular.

Some people who abuse steroids to boost muscle size may have experienced physical or sexual abuse, and are trying to increase their muscle size to protect themselves. In one series of interviews with male weightlifters, 25 percent who abused steroids reported memories of childhood physical or sexual abuse, compared with none who did not abuse steroids. In a study of women weightlifters, twice as many of those who had been raped reported using anabolic steroids and/or another purported muscle-building drug, compared to those who had not been raped. Moreover, almost all of those who had been raped reported that they markedly increased their bodybuilding activities after the attack. They believed that being bigger and stronger would discourage further attacks because men would find them either intimidating or unattractive.

Finally, some adolescents abuse steroids as

part of a pattern of high-risk behaviors. These adolescents also take risks such as drinking and driving, carrying a gun, not wearing a helmet on a motorcycle, and abusing other illicit drugs. While conditions such as muscle dysmorphia, a history of physical or sexual abuse, or a history of engaging in high-risk behaviors may increase the risk of initiating or continuing steroid abuse, researchers agree that most steroid abusers are psychologically normal when they start abusing the drugs.

Some anabolic steroids are taken orally, others are injected intramuscularly, and still others are provided in gels or creams that are rubbed on the skin. Doses taken by abusers can be 10 to 100 times higher than the doses used for medical conditions. Steroid abusers typically "stack" the drugs, meaning that they take two or more different anabolic steroids, mixing oral and/or injectable types and sometimes even including compounds that are designed for veterinary use. Abusers think that the different steroids interact to produce an effect on muscle size that is greater than the effects of each drug individually, a theory that has not been tested scientifically.

Often, steroid abusers also "pyramid" their doses in cycles of 6 to 12 weeks. At the beginning of a cycle, the person starts with low doses of the drugs being stacked and then slowly increases the doses. In the second half of the cycle, the doses are slowly decreased to zero. This is sometimes followed by a second cycle in which the person continues to train but without drugs. Abusers believe that pyramiding allows the body time to adjust to the high doses and the drug-free cycle allows the body's hormonal system time to recuperate. As with stacking, the perceived benefits of pyramiding and cycling have not been substantiated scientifically.

Anabolic steroid abuse has been associated with a wide range of adverse side effects. One study found that exposing male mice for one-fifth of their lifespan to steroid doses comparable to those taken by human athletes caused a high percentage of premature deaths. It is clear, however, that steroid abuse has marked effects on a number of body systems.

## Hormonal System

Steroid abuse disrupts the normal production of hormones in the male body, causing both reversible and irreversible changes. Changes that can be reversed include reduced sperm production and shrinking of the testicles (testicular atrophy). Irreversible changes include male-pattern baldness and breast development (gynecomastia). In one study of male bodybuilders, more than half had testicular atrophy, and more than half had gynecomastia. In the female body, anabolic steroids cause masculinization. Breast size and body fat decrease, the skin becomes coarse, the clitoris enlarges, and the voice deepens. Women may experience excessive growth of body hair but lose scalp hair. With

continued administration of steroids, some of these effects are irreversible.

## Musculoskeletal System

Rising levels of testosterone and other sex hormones normally trigger the growth spurt that occurs during puberty and adolescence. Subsequently, when these hormones reach certain levels, they signal the bones to stop growing, locking a person into his or her maximum height. When a child or adolescent takes anabolic steroids, the resulting artificially high sex hormone levels can signal the bones to stop growing sooner than they normally would have done.

## Cardiovascular System

Steroid abuse has been associated with cardiovascular diseases, including heart attacks and strokes, even in athletes younger than 30. Steroids contribute to the development of cardiovascular problems, partly by changing the levels of lipoproteins that carry cholesterol in the blood. Steroids, particularly the oral types, increase the level of low-density lipoprotein (LDL) and decrease the level of high-density lipoprotein (HDL). High LDL and low HDL levels increase the risk of atherosclerosis, a condition in which fatty substances are deposited inside arteries and disrupt blood flow. Steroids also increase the risk that blood clots will form in blood vessels, potentially disrupting blood flow and damaging the heart muscle so that it does not pump blood effectively, or increasing the risk of stroke.

## Other Effects

Steroid abuse has been associated with liver tumors and a rare condition called peliosis hepatis, in which blood-filled cysts form in the liver. Both the tumors and the cysts sometimes rupture, causing internal bleeding. Steroid abuse can also cause acne, cysts, and oily hair and skin.

Many abusers who inject anabolic steroids use non-sterile injection techniques or share contaminated needles with other abusers. In addition, some steroid preparations are manufactured illegally under non-sterile conditions. These factors put abusers at risk for acquiring life-threatening viral infections, such as HIV and hepatitis B and C. Abusers also can develop infective endocarditis, a bacterial illness that causes a potentially fatal inflammation of the inner lining of the heart. Bacterial infections also can cause pain and abscess formation at injection sites.

Case reports and small studies indicate that anabolic steroids, particularly in high doses, increase irritability and aggression. Some steroid abusers report that they have committed aggressive acts, such as physical fighting, committing armed robbery, or using force to obtain something. Some abusers also report that they have committed property crimes, such as

stealing from a store, damaging or destroying others' property, or breaking into a house or a building. Abusers who have committed aggressive acts or property crimes generally report that they engage in these behaviors more often when they take steroids than when they are drug-free. Some researchers, however, have suggested that steroid abusers may commit aggressive acts and property crimes not because of steroids' direct effects on the brain but because the abusers have been affected by extensive media attention to the link between steroids and aggression. According to this theory, the abusers are using this possible link as an excuse to commit aggressive acts and property crimes.

One way to distinguish between these two possibilities is to administer either high steroid doses or placebo for days or weeks to human volunteers and then ask the people to report on their behavioral symptoms. To date, four such studies have been conducted. In three, high steroid doses did produce greater feelings of irritability and aggression than did placebo; but in one study, the drugs did not have that effect. One possible explanation, according to researchers, is that some but not all anabolic steroids increase irritability and aggression.

Anabolic steroids have been reported to cause other behavioral effects, including euphoria, increased energy, sexual arousal, mood swings, distractibility, forgetfulness, and confusion. In the studies in which researchers administered high steroid doses to volunteers, a minority of the volunteers developed behavioral symptoms that were so extreme as to disrupt their ability to function in their jobs or in society. In a few cases, the volunteers' behavior presented a threat to themselves and others. In summary, the extent to which steroid abuse contributes to violence and behavioral disorders is unknown. As with the health complications of steroid abuse, the prevalence of extreme cases of violence and behavioral disorders seems to be low, but it may be under-reported or under-recognized.

An undetermined percentage of steroid abusers become addicted to the drugs, as evidenced by their continuing to take steroids in spite of physical problems, negative effects on social relations, or nervousness and irritability. Also, they spend large amounts of time and money obtaining the drugs and experience withdrawal symptoms such as mood swings, fatigue, restlessness, loss of appetite, insomnia, reduced sex drive, and the desire to take more steroids. The most dangerous of the withdrawal symptoms is depression, because it sometimes leads to suicide attempts. Untreated, some depressive symptoms associated with anabolic steroid withdrawal have been known to persist for a year or more after the abuser stops taking the drugs.

Few studies of treatments for anabolic steroid abuse have been conducted. Current knowledge is based largely on the experiences of a small number of physicians who have worked with

patients undergoing steroid withdrawal. The physicians have found that supportive therapy is sufficient in some cases. Patients are educated about what they may experience during withdrawal and are evaluated for suicidal thoughts. If symptoms are severe or prolonged, medications or hospitalization may be needed.

Some medications that have been used for treating steroid withdrawal restore the hormonal system after its disruption by steroid abuse. Other medications target specific withdrawal symptoms: for example, antidepressants to treat depression, and analgesics for headaches and muscle and joint pain. Some patients require assistance beyond simple treatment of withdrawal symptoms and are also treated with behavioral therapies.

## Prescription and Over-the-Counter Medications

Prescription medications such as pain relievers, central nervous system (CNS) depressants (tranquilizers and sedatives), and stimulants are highly beneficial treatments for a variety of health conditions. Pain relievers enable individuals with chronic pain to lead productive lives; tranquilizers can reduce anxiety and help patients with sleep disorders; and stimulants help people with attention-deficit hyperactivity disorder (ADHD) focus their attention. Most people who take prescription medications use them responsibly. But when abused—that is, taken by someone other than the patient for whom the medication was prescribed, or taken in a manner or dosage other than what was prescribed—prescription medications can produce serious adverse health effects, including addiction.

Patients, health care professionals, and pharmacists all have roles in preventing the abuse of and addiction to prescription medications. For example, patients should follow the directions for use carefully; learn what effects and side effects the medication could have; and inform their doctor/pharmacist whether they are taking other medications [including over-the-counter (OTC) medications or health supplements], since these could potentially interact with the prescribed medication. The patient should read all information provided by the pharmacist. Physicians and other health care providers should screen for past or current substance abuse in the patient during routine examination, including asking questions about what other medications the patient is taking and why. Providers should note any rapid increases in the amount of a medication needed or frequent requests for refills before the quantity prescribed should have been finished, as these may be indicators of abuse.

Similarly, some OTC medications, such as cough and cold medicines containing dextromethorphan, have beneficial effects when taken as recommended; but they can also be abused



and lead to serious adverse health consequences. Parents should be aware of the potential for abuse of these medications, especially when consumed in large quantities, which should signal concern and the possible need for intervention.

Although almost all prescription drugs can be misused, there are three classes of prescription drugs that are most commonly abused:

**Opioids** are commonly prescribed because of their effective analgesic, or pain-relieving, properties. Medications that fall within this class, sometimes referred to as narcotics, include morphine, codeine, and related drugs. Morphine, for example, is often used before or after surgery to alleviate severe pain. Codeine, because it is less efficacious than morphine, is used for milder pain. Other examples of opioids that can be prescribed to alleviate pain include oxycodone (Percodan or OxyContin, see section on Opiates), propoxyphene (Darvon), hydrocodone (Vicodin), and hydromorphone (Dilaudid), as well as meperidine (Demerol), which is used less often because of its side effects. In addition to their pain-relieving properties, some of these drugs, for example, codeine and diphenoxylate (Lomotil) can be used to relieve coughs and diarrhea.

Chronic use of opioids can result in tolerance for the drugs, which means that users must take higher doses to achieve the same initial effects. Long-term use also can lead to physical dependence and addiction, the body adapts to the presence of the drug, and withdrawal symptoms occur if use is reduced or stopped. Finally, taking a large single dose of an opioid could cause severe respiratory depression that can lead to death. Opioids are safe to use with other drugs only under a physician's supervision. Typically, they should not be used with other substances that depress the central nervous system, such as alcohol, antihistamines, barbiturates, benzodiazepines, or general anesthetics; as such a combination increases the risk of life-threatening respiratory depression.

**CNS Depressants** are substances that can slow normal brain function. Because of this property, some CNS depressants are useful in the treatment of anxiety and sleep disorders. Barbiturates, such as mephobarbital (Mebaral) and pentobarbital sodium (Nembutal), are used to treat anxiety, tension, and sleep disorders. Benzodiazepines, such as diazepam (Valium), chlordiazepoxide HCl (Librium), and alprazolam (Xanax), can be prescribed to treat anxiety, acute stress reactions, and panic attacks; the more sedating benzodiazepines, such as triazolam (Halcion) and estazolam (ProSom) can be prescribed for short-term treatment of sleep disorders. In higher doses, some CNS depressants can also be used as general anesthetics. Most CNS depressants work in the brain by increasing the activity of the neurotransmitter GABA.

Despite their many beneficial effects, barbiturates and benzodiazepines have the potential

for abuse and should be used only as prescribed. During the first few days of taking a prescribed CNS depressant, a person usually feels sleepy and uncoordinated, but as the body becomes accustomed to the effects of the drug, these feelings begin to disappear. If one uses these drugs long term, the body will develop tolerance for the drugs, and larger doses will be needed to achieve the same initial effects. In addition, continued use can lead to physical dependence and, when use is reduced or stopped, withdrawal. Because all CNS depressants work by slowing the brain's activity, when an individual stops taking them, the brain's activity can rebound and race out of control, possibly leading to seizures and other harmful consequences. Although withdrawal from benzodiazepines can be problematic, it is rarely life threatening, whereas withdrawal from prolonged use of other CNS depressants can have life-threatening complications. Therefore, someone who is thinking about discontinuing CNS depressant therapy or who is suffering withdrawal from a CNS depressant should speak with a physician or seek medical treatment.

CNS depressants should be used with other medications only under a physician's supervision. Typically, they should not be combined with any other medication or substance that causes CNS depression, including prescription pain medicines, some over-the-counter cold and allergy medications, or alcohol. Using CNS depressants with these other substances, particularly alcohol, can slow breathing, or slow both the heart and respiration, and possibly lead to death.

**Stimulants**, (amphetamines [Adderall, Dexedrine] and methylphenidate [Concerta, Ritalin]) increase alertness, attention, and energy. They also increase blood pressure and heart rate, constrict blood vessels, increase blood glucose, and open up the pathways of the respiratory system. Historically, stimulants were prescribed to treat asthma and other respiratory problems, obesity, neurological disorders, and a variety of other ailments. As their potential for abuse and addiction became apparent, the prescribing of stimulants by physicians began to wane. Now, stimulants are prescribed for treating only a few health conditions, most notably ADHD, narcolepsy, and, in some instances, depression that has not responded to other treatments.

They have chemical structures that are similar to key brain neurotransmitters called monoamines, which include norepinephrine and dopamine. Stimulants increase the amount of these chemicals in the brain. This, in turn, increases blood pressure and heart rate, constricts blood vessels, increases blood glucose, and opens up the pathways of the respiratory system. In addition, the increase in dopamine is associated with a sense of euphoria that can accompany the use of these drugs. The consequences of stimulant abuse can be dangerous. Although their use may not lead to physical dependence and risk

of withdrawal, stimulants can be addictive in that individuals begin to use them compulsively. Taking high doses of some stimulants repeatedly over a short time can lead to feelings of hostility or paranoia. Additionally, taking high doses of a stimulant may result in dangerously high body temperatures and an irregular heartbeat. There is also the potential for cardiovascular failure or lethal seizures.

Stimulants should be used with other medications only when the patient is under a physician's supervision. For example, a stimulant may be prescribed to a patient taking an antidepressant. However, healthcare providers and patients should be mindful that antidepressants enhance the effects of a stimulant. Patients also should be aware that stimulants should not be mixed with over-the-counter cold medicines that contain decongestants, as this combination may cause blood pressure to become dangerously high or lead to irregular heart rhythms.

**Dextromethorphan** (sometimes called "DXM" or "robo") is a cough-suppressing ingredient in a variety of over-the-counter cold and cough medications. Like PCP and ketamine, dextromethorphan acts as an NMDA receptor antagonist. The most common source of abused dextromethorphan is "extra-strength" cough syrup, which typically contains 3 milligrams of the drug per milliliter of syrup. At the doses recommended for treating coughs (1/6 to 1/3 ounce of medication, containing 15 mg to 30 mg dextromethorphan), the drug is safe and effective. At much higher doses (4 or more ounces), dextromethorphan produces dissociative effects similar to those of PCP and ketamine. The effects vary with dose, and dextromethorphan users describe a set of distinct dose-dependent "plateaus" ranging from a mild stimulant effect with distorted visual perceptions at low (approximately 2-ounce) doses to a sense of complete dissociation from one's body at doses of 10 ounces or more. The effects typically last for 6 hours. Over-the-counter medications that contain dextromethorphan often contain antihistamine and decongestant ingredients as well, and high doses of these mixtures can seriously increase risks associated with dextromethorphan abuse.

## Management of Drug Overdose

Because so many illicit drugs are abused in combination, management of an overdose can be extremely complex. Treatment of each must be individual, and only general treatment guidelines are offered here.

Symptomatic and supportive care is the basis for treatment of a drug overdose; the primary goal is to insure adequate vital functions.

1. Patient assessment is critical to determine the adequacy of respiratory and cardiac function. Note the integrity of reflexes (corneal, pupil, gag and deep tendon.)

2. If the patient is asymptomatic because he has not absorbed a sufficient quantity of the drug, vomiting may be induced. This must not be done if there is central nervous system depression, however. Activated charcoal powder may be given, or gastric lavage performed. If the patient demonstrates decreased consciousness during the procedure, however, he should be intubated before the lavage is started.
3. If the patient's level of consciousness is decreased, all treatment should be directed toward maintaining cardiac and respiratory function. Provide ventilation by mouth-to-mouth, use of an Ambubag, or respirator until the patient is oxygenated. Intubation and suction, plus monitoring of blood gases, follow management of the emergency.
4. Adequate hydration should be maintained with IV fluids, and central venous pressure should be monitored.
5. Insert indwelling urinary catheter and monitor output.
6. Gastric lavage should be performed only after vital functions are adequate and supportive measures to maintain them have been implemented.
7. Specific antidotes for drug overdoses are few and should only be used with definite indications. Never use them prophylactically.
8. Unnecessary drugs should be avoided. CNS stimulants are not advised as they may result in seizures. Supportive care is most important now.
9. Continued care with close monitoring of vital functions may be needed for an extended period of time. Coma may persist for days.
10. Observe carefully for the common complication of aspiration: pneumonia and subsequent infection.
11. Initial aspiration fluids should be saved for toxicological analysis, as should the first urine sample. This may have an important effect upon treatment.
12. If the patient survives, be sure he is referred for counseling and follow-up care.

So, what is the next step to gaining some ground in this cycle of addiction?

## Treatment Approaches for Addiction

Drug addiction is a complex illness characterized by intense and, at times, uncontrollable drug craving, along with compulsive drug

seeking and use that persist even in the face of devastating consequences. While the path to drug addiction begins with the voluntary act of taking drugs, over time a person's ability to choose not to do so becomes compromised, and seeking and consuming the drug becomes compulsive. This behavior results largely from the effects of prolonged drug exposure on brain functioning. Addiction is a brain disease that affects multiple brain circuits, including those involved in reward and motivation, learning and memory, and inhibitory control over behavior.

Because drug abuse and addiction have so many dimensions and disrupt so many aspects of an individual's life, treatment is not simple.

Effective treatment programs typically incorporate many components, each directed to a particular aspect of the illness and its consequences. Addiction treatment must help the individual stop using drugs, maintain a drug-free lifestyle, and achieve productive functioning in the family, at work, and in society. Because addiction is typically a chronic disease, people cannot simply stop using drugs for a few days and be cured. Most patients require long-term or repeated episodes of care to achieve the ultimate goal of sustained abstinence and recovery of their lives.

### Key Principles of Effective Treatment

Scientific research since the mid-1970s shows that treatment can help patients addicted to drugs stop using, avoid relapse, and successfully recover their lives. Based on this research, key principles have emerged that should form the basis of any effective treatment programs:

- ◆ Addiction is a complex but treatable disease that affects brain function and behavior.
- ◆ No single treatment is appropriate for everyone.
- ◆ Treatment needs to be readily available.
- ◆ Effective treatment attends to multiple needs of the individual, not just his or her drug abuse.
- ◆ Remaining in treatment for an adequate period of time is critical.
- ◆ Counseling—individual and/or group—and other behavioral therapies are the most commonly used forms of drug abuse treatment.
- ◆ Medications are an important element of treatment for many patients, especially when combined with counseling and other behavioral therapies.
- ◆ An individual's treatment and services

plan must be assessed continually and modified as necessary to ensure that it meets his or her changing needs.

- ◆ Many drug-addicted individuals also have other mental disorders.
- ◆ Medically assisted detoxification is only the first stage of addiction treatment and by itself does little to change long-term drug abuse.
- ◆ Treatment does not need to be voluntary to be effective.
- ◆ Drug use during treatment must be monitored continuously, as lapses during treatment do occur.
- ◆ Treatment programs should assess patients for the presence of HIV/AIDS, hepatitis B and C, tuberculosis, and other infectious diseases as well as provide targeted risk-reduction counseling to help patients modify or change behaviors that place them at risk of contracting or spreading infectious diseases.

### Effective Treatment Approaches

Medication and behavioral therapy, especially when combined, are important elements of an overall therapeutic process that often begins with detoxification, followed by treatment and relapse prevention. Easing withdrawal symptoms can be important in the initiation of treatment; preventing relapse is necessary for maintaining its effects. And sometimes, as with other chronic conditions, episodes of relapse may require a return to prior treatment components. A continuum of care that includes a customized treatment regimen—addressing all aspects of an individual's life, including medical and mental health services—and follow-up options (e.g., community- or family-based recovery support systems) can be crucial to a person's success in achieving and maintaining a drug-free lifestyle.

#### Medications

Medications can be used to help with different aspects of the treatment process.

**Withdrawal.** Medications offer help in suppressing withdrawal symptoms during detoxification. However, medically assisted detoxification is not in itself "treatment"—it is only the first step in the treatment process. Patients who go through medically assisted withdrawal but do not receive any further treatment show drug abuse patterns similar to those who were never treated.

**Treatment.** Medications can be used to help reestablish normal brain function and to prevent relapse and diminish cravings. Currently, there are medications available for opioids (heroin, morphine), and are developing others for treating stimulant (cocaine, methamphetamine) and cannabis (marijuana) addiction. Most people with severe addiction problems, however, are polydrug users (users of more than one drug) and will require treatment for all of the substances that they abuse.

- **Opioids:** Methadone, buprenorphine and, for some individuals, naltrexone are effective medications for the treatment of opiate addiction. Acting on the same targets in the brain as heroin and morphine, methadone and buprenorphine suppress withdrawal symptoms and relieve cravings. Naltrexone works by blocking the effects of heroin or other opioids at their receptor sites and should only be used in patients who have already been detoxified. Because of compliance issues, naltrexone is not as widely used as the other medications. All medications help patients disengage from drug seeking and related criminal behavior and become more receptive to behavioral treatments.

## Behavioral Treatments

Behavioral treatments help patients engage in the treatment process, modify their attitudes and behaviors related to drug abuse, and increase healthy life skills. These treatments can also enhance the effectiveness of medications and help people stay in treatment longer. Treatment for drug abuse and addiction can be delivered in many different settings using a variety of behavioral approaches.

**Outpatient behavioral treatment** encompasses a wide variety of programs for patients who visit a clinic at regular intervals. Most of the programs involve individual or group drug counseling.

Some programs also offer other forms of behavioral treatment such as:

- **Cognitive-behavioral therapy**, which seeks to help patients recognize, avoid, and cope with the situations in which they are most likely to abuse drugs.

- **Multidimensional family therapy**, which was developed for adolescents with drug abuse problems—as well as their families—addresses a range of influences on their drug abuse patterns and is designed to improve overall family functioning.

- **Motivational interviewing**, which capitalizes on the readiness of individuals to change their behavior and enter treatment.

- **Motivational incentives** (contingency management), which uses positive reinforcement to encourage abstinence from drugs.

- **Residential treatment programs** can also be

very effective, especially for those with more severe problems. For example, therapeutic communities (TCs) are highly structured programs in which patients remain at a residence, typically for 6 to 12 months. TCs differ from other treatment approaches principally in their use of the community—treatment staff and those in recovery—as a key agent of change to influence patient attitudes, perceptions, and behaviors associated with drug use.

Patients in TCs may include those with relatively long histories of drug addiction, involvement in serious criminal activities, and seriously impaired social functioning. TCs are now also being designed to accommodate the needs of women who are pregnant or have children. The focus of the TC is on the resocialization of the patient to a drug-free, crime-free lifestyle.

## Treatment Within the Criminal Justice System

Treatment in a criminal justice setting can succeed in preventing an offender's return to criminal behavior, particularly when treatment continues as the person transitions back into the community. Studies show that treatment does not need to be voluntary to be effective.

## Prevention Is The Key

In more than 25 years of drug abuse research, NIDA has identified important principles for prevention programs in the family, school, and community. NIDA-supported researchers have tested these principles in long-term drug abuse prevention programs and have found them to be effective. It should be noted that healthcare professionals are often in a unique position to influence and implement both the prevention and treatment of drug abuse.

Effective intervention for prevention can occur during one-to-one interactions with patients as well as in the context of community wide programs.

Prevention programs should be designed to enhance “protective factors” and move toward reversing or reducing known “risk factors.” Protective factors are those associated with reduced potential for drug use. Risk factors are those that make the potential for drug use more likely:

1. Protective factors include strong and positive bonds within a prosocial family; parental monitoring; clear rules of conduct that are consistently enforced within the family; involvement of parents in the lives of their children; success in school performance; strong bonds with other prosocial institutions, such as school and religious organizations; and adoption of conventional norms about drug use.

2. Risk factors include chaotic home environments, particularly in which parents abuse substances or suffer from mental illnesses; ineffective parenting, especially with children with difficult temperaments or conduct disorders; lack of mutual attachments and nurturing; inappropriately shy or aggressive behavior in the classroom; failure in school performance; poor social coping skills; affiliations with deviant peers or peers displaying deviant behaviors; and perceptions of approval of drug-using behaviors in family, work, school, peer, and community environments.

- ◆ Prevention programs may target a variety of drugs of abuse, such as tobacco, alcohol, inhalants, and marijuana or may target a single area of drug abuse such as the misuse of prescription drugs.

- ◆ Prevention programs should include general life skills training and training in skills to resist drugs when offered, strengthen personal attitudes and commitments against drug use, and increase social competency (e.g., in communications, peer relationships, self-efficacy, & assertiveness).

- ◆ Prevention programs for children and adolescents should include developmentally appropriate interactive methods, such as peer discussion groups and group problem solving and decision making, rather than didactic teaching techniques alone.

- ◆ Prevention programs should include parents' or caregivers' components that train them to use appropriate parenting strategies, reinforce what the children are learning about drugs and their harmful effects, and open opportunities for family discussions about the use of legal and illegal substances and family policies about their use.

- ◆ Prevention programs should be long-term (throughout the school career), with repeat interventions to reinforce the original prevention goals. For example, school-based efforts directed at elementary and middle school students should include booster sessions to help with the critical transitions such as from middle to high school.

- ◆ Family-focused prevention efforts have a greater impact than strategies that focus on parents only or children only.

- ◆ Community programs that include media campaigns and policy changes, such as new regulations that restrict access to



alcohol, tobacco, or other drugs, are more effective when they are accompanied by school and family interventions.

- ◆ Community programs need to strengthen norms against drug use in all drug abuse prevention settings, including the family, the school, the workplace and the community.

- ◆ Schools offer opportunities to reach all populations and also serve as important settings for specific subpopulations at risk for drug abuse, such as children with behavior problems or learning disabilities and those who are potential dropouts.

- ◆ Prevention programming should be adapted to address the specific nature of the drug abuse problem in the local community.

- ◆ The higher the level of risk of the target population, the more intensive the prevention effort must be and the earlier it must begin.

- ◆ Prevention programs should be age-specific, developmentally appropriate, and culturally sensitive.

- ◆ Effective prevention programs are cost-effective. For every \$1 spent on drug use prevention, communities can save \$4 to \$5 in costs for drug abuse treatment and counseling.

## Too Often, Addiction Goes Untreated

To date, according to SAMHSA's National Survey on Drug Use and Health (NSDUH), 23.2 million persons (9.4 percent of the U.S. population) aged 12 or older needed treatment for an illicit drug or alcohol use problem. Of these individuals, 2.4 million (10.4 percent of those who needed treatment) received treatment at a specialty facility (i.e., hospital, drug or alcohol rehabilitation or mental health center). Thus, 20.8 million persons (8.4 percent of the population aged 12 or older) needed treatment for an illicit drug or alcohol use problem but did not receive it. These estimates are similar to those in previous years.

One cannot be aware of the drug problem facing this country and its people without wondering about solutions. Should we barricade the borders to keep the smugglers out? Crack down even harder on clandestine chemists? Napalm growing plants in the fields of this and other countries? Is the answer to be found in stiffer sentences for dealers, more random urine testing, tougher laws?

Or do we focus on the users? What can we do to stop someone from taking the first hit on a joint, popping his first pill, sticking that needle into his arm? There are no easy answers, but one thing does seem clear: comprehensive, patient-centered treatment and prevention programs may represent our best hope for a brighter, drug-free future for us all.

The National Institute on Drug Abuse (NIDA) publishes a series of excellent Research Reports on the various drugs of abuse, many of which were excerpted in the preparation of this course. A list of available Reports may be obtained at [www.nida.nih.gov/ResearchReports/ResearchIndex.html](http://www.nida.nih.gov/ResearchReports/ResearchIndex.html), or by contacting the National Clearinghouse on Alcohol and Drug Information, P.O. Box 2345, Rockville, MD 20852.

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## Additional Sources of Useful Information:

Arnstein P "Is my patient drug-seeking or in need of pain relief?" *Nursing*, 2010 May; 40(5): p60-1

Burrow-Sanchez JJ, Lopez AL, Slagle CP "Perceived competence in addressing student substance abuse: a national survey of middle school counselors." *J Sch Health*, 2008 May; 78(5): p280-6

Conners-Burrow NA, Johnson B, Whiteside-Mansell L "Maternal substance abuse and children's exposure to violence." *J Pediatr Nurs* 2009 Oct; 24(5): p360-8

Flaskerud JH "Cultural context and treatment for substance-related disorders: an invitation." *Issues Ment Health Nurs* 2008 Apr; 29(4): p427-31

Frosch, D. (2010). "V.A. Easing Rules for Users of Medical Marijuana" *N.Y. Times* [Online], Available:[http://www.nytimes.com/2010/07/24/health/policy/24veterans.html?pagewanted=1&\\_r=2&pagewanted](http://www.nytimes.com/2010/07/24/health/policy/24veterans.html?pagewanted=1&_r=2&pagewanted)

Gonzalez-Guarda RM, Ortega J, Vasquez EP, et al. "La mancha negra: substance abuse, violence, and sexual risks among Hispanic males." *West J Nurs Re* 2010 Feb; 32(1): p128-48

Lefebvre L, Midmer D, Boyd JA, et al. "Participant perception of an integrated program for substance abuse in pregnancy." *J Obstet Gynecol Neonatal Nurs* 2010 Jan; 39(1): p46-52

London F "Psychoeducation. Patient education gets respect." *Home Healthc Nurse*, Apr 2008, 26(4) p209-11

Monroe T "Addressing substance abuse among nursing students: development of a prototype alternative-to-dismissal policy." *J Nurs Educ* 2009 May; 48(5): p272-8

Simmons S "Teens and prescription drugs: a potentially dangerous combination." *Nursing*, 2010 May; 40(5): p42-6

Sircy RA, Stojanoski A "ADHD treatment and the risk of substance abuse." *Nurse Pract*, 2008 Apr; 33(4): p33-6

Smith CS "Substance abuse, chronic sorrow, and mothering loss: relapse triggers among female victims of child abuse." *J Pediatr Nurs* 2009 Oct; 24(5): p401-12

Watson DS "The code of silence." *AORN J*, 2009 Nov; 90(5): p761-3

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## Instructions to the learner:

- The questions are to be answered either A, B, C, or D.  
There is only one correct answer.

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1. According to the text, experts in addiction medicine define substance addiction as:
  - A. the ingestion of a chemically active agent
  - B. a compulsive, maladaptive dependence resulting in adverse physical, psychological and legal outcomes
  - C. a maladaptive pattern of use leading to difficulties in meeting major obligations
  - D. a cluster of cognitive, behavioral and physical symptoms with continued use despite problems
2. Development of tolerance for a drug, with increasing amounts needed to produce the desired effect, is considered an indication of drug:
  - A. use
  - B. abuse
  - C. dependence
  - D. preference
3. The largest and most highly developed structure in the human brain, responsible for complex thought and action, is the:
  - A. cerebral cortex
  - B. cerebellum
  - C. diencephalon
  - D. limbic system
4. Neurotransmission, the transfer of a message from one nerve cell to another, is accomplished through:
  - A. direct contact between the axon of one cell and the dendrites of another
  - B. release of chemical substances into the space between the cells
  - C. an electrical charge created between the cell's nuclei
  - D. all of the above
5. The mesolimbic dopamine system of the brain, also known as the pleasure circuit, contains all of the following structures except
  - A. the nucleus accumbens in the limbic system
  - B. the ventral tegmental area of the brainstem
  - C. the cerebellar hemispheres
  - D. the frontal cerebral cortex
6. Drugs that affect the way the brain works do so by:
  - A. mimicking the effects of a natural neurotransmitter
  - B. blocking neuroreceptors
  - C. causing excessive release of neurotransmitters
  - D. all of the above
7. Marijuana creates feelings of euphoria, relaxation, and heightened sensation by:
  - A. stimulating the dopamine pathway within the pleasure circuit
  - B. causing cascades of serotonin to be released into the brain
  - C. increasing the activity level of neurons throughout the brain
  - D. causing the brain to create more cannabinoid receptors
8. A relatively new drug on the market, known as Spice, or K2 is a synthetic form of:
  - A. marijuana
  - B. cocaine
  - C. heroin
  - D. Ketamine
9. Adverse physical effects of marijuana use include:
  - A. chronic diarrhea
  - B. loss of appetite
  - C. headache
  - D. itchy, scaly skin
10. In addition to adolescents and young adults, persons at high risk for development of marijuana abuse include those:
  - A. diagnosed with post-traumatic stress disorder
  - B. subjected to chronic low levels of stress
  - C. engaged in high risk occupations
  - D. all of the above
11. In comparison to powder cocaine, "crack" is:
  - A. more likely to be injected or inhaled
  - B. preferred for the slow, steady euphoria it produces
  - C. unlikely to produce addiction or other health consequences
  - D. less expensive to produce and to buy
12. The process of inhaling cocaine powder through the nostrils, where it is absorbed into the bloodstream through the nasal tissues, is known as:
  - A. huffing
  - B. snorting
  - C. mainlining
  - D. freebasing
13. Medical complications of cocaine use include all of the following except:
  - A. loss of sense of smell
  - B. neurological problems such as seizure or stroke
  - C. significant weight gain
  - D. abdominal pain and nausea
14. Research has indicated that "crack babies," whose mothers used cocaine during their pregnancy:
  - A. suffered severe brain damage leading to reduced intelligence and lack of social skills
  - B. are likely to have reduced life expectancy
  - C. may have difficulty concentrating when they reach school age
  - D. should expect no ill effects from the cocaine exposure
15. Treatment of individuals for cocaine addiction is complicated by the fact that they:
  - A. may have sustained permanent biological changes in their brains
  - B. often use multiple drugs in addition to cocaine
  - C. present with a wide variety of psychological and social issues
  - D. all of the above
16. Most of the methamphetamine used in the United States is:
  - A. imported from Asia and South America
  - B. manufactured in small clandestine laboratories from inexpensive, easy to obtain materials
  - C. diverted from pharmacy stocks intended for legitimate medical use
  - D. smuggled in from Europe, where it is legal

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17. Oral ingestion of methamphetamine produces:
  - A. an immediate, intensely pleasurable rush that lasts for about three minutes
  - B. a noticeable high within fifteen to twenty minutes of the dose
  - C. marked agitation and paranoia in most users
  - D. feelings of alertness and well being that can last for days
18. Long-term abusers of methamphetamine may experience "formication", which is:
  - A. gradual deformity of the face and neck
  - B. engaging in illicit sex in exchange for drugs
  - C. the sensation of insects crawling on one's skin
  - D. excess production of mucus
19. Chronic use of methamphetamine leads to:
  - A. chronic somnolence and fatigue
  - B. damage to dopamine producing cells in the brain
  - C. clear physical manifestations of withdrawal
  - D. an irreversible psychotic state
20. Emergency room treatment of amphetamine overdose should focus on:
  - A. immediate physical symptoms of hyperthermia or convulsions
  - B. administration of prophylactic doses of narcoleptics for possible psychosis
  - C. use of benzodiazepines to calm the patient
  - D. sedation and observation
21. At this time the most effective treatments for methamphetamine abuse are:
  - A. antidepressants
  - B. anxiolytics combined with group and family counseling
  - C. cognitive and behavioral interventions
  - D. 12 step recovery support programs
22. Abuse of Ritalin and other medications used to treat ADHD has been documented among
  - A. elementary school children
  - B. middle and high school students
  - C. street addicts
  - D. all of the above
23. Two important effects produced by the naturally occurring endorphins and opiate drugs alike are:
  - A. enhanced alertness and energy
  - B. pleasure and pain relief
  - C. euphoria and relaxation
  - D. confidence and sociability
24. Death from a heroin overdose is usually due to:
  - A. asphyxiation from aspiration of stomach contents
  - B. severe cardiac arrhythmia
  - C. uncontrolled seizures
  - D. to brain stem mediated respiratory arrest
25. Heroin is preferred over other opiates by most street users because it:
  - A. enters the brain and produces its effects more quickly
  - B. is more predictable in its strength, duration, and effects
  - C. can be obtained more easily
  - D. is less likely to cause addiction
26. Symptoms of heroin withdrawal include all of the following except:
  - A. muscle and bone pain
  - B. "cold turkey"
  - C. somnolence and stupor
  - D. diarrhea and vomiting
27. Medications that may be used to treat heroin addiction include:
  - A. buprenorphine
  - B. diazepam
  - C. meperidine
  - D. phencyclidine
28. Buprenorphine is an attractive treatment for heroin addiction because it
  - A. produces less risk for overdose and withdrawal:
  - B. is less expensive than alternative medications
  - C. has a proven track record in the United States
  - D. all of the above
29. The opiate analog drug MPTP causes its users to develop:
  - A. decreased tolerance for heroin, with increased risk for overdose
  - B. clubbing of the fingers and toes
  - C. Parkinson-like immobility
  - D. heart arrhythmias and respiratory problems
30. Which of the following hallucinogens is considered to be addictive?
  - A. LSD
  - B. MDMA
  - C. mescaline
  - D. psilocybin
31. LSD users may experience synesthesia, which is defined as:
  - A. feeling that one's body is changing shape
  - B. perceiving oneself as hearing colors or seeing sounds
  - C. experiencing several emotions simultaneously
  - D. fearing death or loss of control
32. Research and clinical evidence indicate that LSD-induced persistent psychosis
  - A. may result in marked blunting of affect
  - B. includes vivid visual disturbances and hallucinations
  - C. usually occurs after prolonged, regular LSD use
  - D. only affects persons with a history of psychological problems
33. A dose of 5mg or less of PCP is likely to produce
  - A. slow, labored breathing
  - B. elevated blood pressure
  - C. hypothermia
  - D. insensitivity to pain
34. An overdose of dextromethorphan, found in over the counter cough and cold remedies, is likely to produce
  - A. distorted visual perceptions
  - B. feelings of dissociation
  - C. ketamine-like effects
  - D. all of the above
35. The street names Adam, hug, and beans refer to the club drug
  - A. MDMA
  - B. LSD
  - C. ketamine
  - D. methamphetamine
36. Recent studies have indicated that use of Ecstasy may result in
  - A. significant reduction of serotonin producing brain cells
  - B. birth defects in children of chronic users
  - C. persistent symptoms of paranoia and disorientation
  - D. all of the above
37. All of the following drugs have been frequently implicated in "drug rape" except
  - A. ketamine
  - B. GHB
  - C. rohypnol
  - D. LSD

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38. Nitrites are considered to be a special class of inhalants because they:
  - A. act on the blood vessels and muscles rather than the brain
  - B. are not available in any commercial products
  - C. are used primarily by children and younger adolescents
  - D. act as mood enhancers
39. Data from national and state surveys indicate that inhalant abuse:
  - A. reaches its peak during 11th and 12th grade
  - B. is consistently more common among boys than girls
  - C. very rarely extends into adulthood
  - D. is associated with poor grades and school dropouts
40. Most inhalants produce their effects by:
  - A. depressing the central nervous system
  - B. acting as CNS stimulants
  - C. binding to opiate receptors in the brain's pleasure circuit
  - D. altering glucose metabolism in the brain
41. DHEA and Andro, taken for their muscle-building effects, are available
  - A. for legal purchase in health food stores
  - B. by prescription only
  - C. by mail or Internet order from foreign sources only
  - D. only from illegal manufacturers
42. Steroid abuse is higher among:
  - A. elementary and middle school-age boys
  - B. males than females
  - C. professional athletes
  - D. middle age and older men
43. One of the main reasons people give for using steroids is to:
  - A. improve their performance in sports
  - B. counter the side effects of cardiovascular medications
  - C. slow the aging process
  - D. enhance sexual arousal and performance
44. The most commonly abused classes of prescription drugs include all of the following except:
  - A. opioids
  - B. stimulants
  - C. anticonvulsants
  - D. CNS depressants
45. Intubation of the drug overdose patient should occur:
  - A. immediately upon admission as a precautionary measure
  - B. upon completion of gastric lavage
  - C. whenever the patient's level of consciousness begins to decline
  - D. after administration of specific drug antidotes
46. Key principles for effective treatment programs include all of the following except:
  - A. Treatment needs to be available and readily accessible.
  - B. The treatment plan should be modified as necessary to meet multiple needs.
  - C. Adequate duration of treatment is critical for success.
  - D. Treatment should focus on the drug abuse rather than related psychosocial issues.
47. A customized treatment regimen includes \_\_\_\_\_ to assist in maintaining a drug-free lifestyle.
  - A. options to return to prior treatment
  - B. medical and mental health services
  - C. follow-up options (recovery support systems)
  - D. all of the above
48. Outpatient behavioral treatment encompasses:
  - A. cognitive-behavioral therapy
  - B. multidimensional family therapy
  - C. motivational interviewing and incentives
  - D. all of the above treatments
49. Prevention programs designed with "Protective factors" are associated with reduced potential for drug use and include:
  - A. strong and positive family bonds
  - B. clear and consistent rules of conduct
  - C. acceptance of conventional norms regarding drug abuse
  - D. all of the above
50. Effective drug abuse prevention programs are:
  - A. very expensive, but necessary to prevent human suffering
  - B. disappearing due to competing claims on the shrinking health care dollar
  - C. cost effective in reducing community expenditures for drug treatment and counseling
  - D. increasingly seen as the responsibility of the private sector

~ End Test ~

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